ELECTRICAL
WEST
A McGRAW-HILL PUBLICATION
January 1961
50 Cents
SPECIAL THIS ISSUE: Construction Industry Report
Features / Statistics / Costs / Proposed Projects / New Products / News

Strandvise® alone

has these straight-down-the-line abilities

FEED-THRU *ability*

Nothing approaches the value and ease of the feed-thru mechanical chuck for placing and tensioning a guy. Use no tensioning tools until after the guy is in place. Then each click of the hoist feeds strand thru the chuck to desired tension.

ONE-MAN *ability*

A one man "crew" can complete a down guy easier, faster and safer than with any other method. Strandvise is a "natural" even for EHS strand.

USE *ability*

No precision pre-cutting. No markers to locate and line up. No size color codes to remember.

NO-CORRODE *ability*

External—Tube and yoke are each a homogeneous aluminum alloy. There is no coating . . . scratching or abrasion cannot initiate corrosion.

Internal—Both laboratory tests and field service exposure (natural cycling) have repeatedly failed to show evidence of corrosive attack on strand within the gripping area. Tapers and initial tension wedge and seal that area.

RE-USE *ability*

Strandvise is wholly reusable; once, twice, or a dozen times.

ADJUST *ability*

Luck plays no part during the tensioning operation. Strandvise "swallows" strand with each click of the hoist—Tension is a fact.

NO-ABRASION *ability*

The stainless steel bail has no peers. There is no coating to abrade away. 18-8 stainless steel will never rust or deteriorate in any known corrosive atmosphere.

REACH *ability*

The overall length of Strandvise averages less than 12 inches for most sizes.

SAFE *ability*

No need to remove come-along or hoist to gain working space before the job is completed. With Strandvise the load is always captive.

NATURAL *ability*

Nothing to study—nothing to avoid—nothing to ("look-out!") for—wholly safe to install without safety glasses and gloves (where regulations permit).

NO-FOUL-UP *ability*

The only wire is the guy wire. The only ingenuity called for is already built into Strandvise.

PROCEDURE *ability*

Give or take guess work is no part of Strandvise—nothing to get ready, nothing to allow for. (Stainless bail cannot stretch.)

MULTIPLE GUY *ability*

Double and triple guying to one guy rod presents no working space problems with Strandvise.

TAMPER-PROOF *ability*

Mischievous release is impossible unless the "villain" has a hoist and come-along.

COST *ability*

You can use every Strandvise you buy . . . none are rendered useless by storage or handling damage, or by field mistakes.

Installed costs favor Strandvise all the way. One man for five minutes is all the "help" Strandvise needs for a *completed* down guy.

HOLDING *ability*

Forged and case hardened chucks are quality controlled at factory and are consistent by nature of design and tooling. No grit or combination of coatings to be controlled and trusted.

During 27 years of continuing production, it has never been reported that a Reliable Feed-Thru Deadend Chuck let go a line. (Strandvise is in its twelfth year of production.)

Reliable

A Symbol of Integrity Since 1909

RELIABLE ELECTRIC COMPANY

Franklin Park, Illinois

This Is America

Everywhere in the West there are subversive minorities who, sheltered by our humanitarianism and our sense of justice, hold the incendiary torches ready, with nothing to stop the spread of their ideas except the critical reason of a single, fairly intelligent, mentally stable stratum of the population.

THE UNDISCOVERED SELF BY C. G. JUNG

We live in a wonderful, exciting and highly rewarding country. Most of us want to keep it that way. We enjoy material comforts in abundance. Most of us look forward to even greater luxuries for ourselves and our children. We have more leisure time than any people in history and we have the freedom to indulge in the personal pleasures of our choice. Most of us take this for granted.

It's not so much that we are smart. Rather we are just plain lucky—lucky to have been born on a rather small section of the globe that has come to be the United States of America. We are lucky because this particular spot, up to now, has been endowed by nature with bountiful resources and raw materials. We are lucky because the heritage of our forefathers included deeply entrenched traits of thrift, initiative, independence and love of justice. We're lucky because some farsighted men met together in a little court house 186 years ago and put down on paper words that shattered the tradition of centuries and released individual men for the pursuit of happiness of their own choosing.

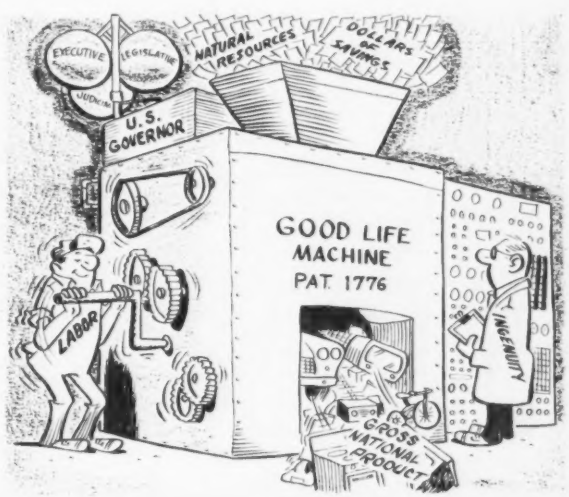
That was the birth of a new system of living— a new experiment in social intercourse. Today, that experiment has become the marvel and the envy of the entire world. Most of us would like to keep that system.

The textbooks and the experts call it the American economic system, the free enterprise system, the capitalistic system or other some such formidable term. Actually it's nothing more than a way of living together. From its simple beginning, based just on a few inalienable rights of each individual, it has grown more and more complicated so that no one really can be said to understand it in its entirety. But, even though its workings may appear complex and baffling to most of us, the basic economic principles remain the same. As long as we keep them intact, we can all look forward to participating in the ever-growing bounty that the system has proved it can produce.

A few of the most important of these basic economic principles are:

1. We can all *have* more if we *produce* more—more products, higher wages, greater leisure.
2. We can produce more by using new and better tools more efficiently.
3. The country's productive machine must expand continually to provide jobs for our ever-growing population, and products to keep people happy.
4. The new tools for increased production and expansion must be bought out of the *savings of the people* in one form or another.
5. Increased productivity must be attained with decreasing unit costs of products so that everyone can share in the gains, either through lower prices or increased wages.

So it is important to remember these basic principles. Our livelihood, even our very lives, depend on them. If we believe in them, we must be ready to repel attacks, from whatever source, that would weaken or destroy them. The trouble is that our country has grown big, rich and complex in its day-to-day operation. Out of all the reforms and improvements to the system that are continually recommended, it's not easy to know which proposals attack the foundation of the system and which merely change its superstructure. In future discussions on the various aspects of the American system, we hope to be able to provide some yardsticks for appraisals. Then you and I, as responsible citizens with a big personal stake in our country's future, may better judge the merits of the ever-increasing number of attempts to modify, change and otherwise tinker with the system that has made our country great and given us the abundant life.



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Cover: For Rogue Valley Manor's run of underground service from California Oregon Power's pole, Charles Johnson, superintendent for Trowbridge & Flynn, electrical contractor, was up on the extension ladder to direct the preparation of the pothead when W. A. Cyr, consulting editor, took this color picture showing the big retirement home under construction on the hill.

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SILENCE IS THE SOUND OF QUALITY

. . . In the NEW ADVANCE Sound Conditioned 40-Watt Two-Lamp Rapid Start Fluorescent Lamp Ballasts

A SOUND RATED

Now, through continuing research and development, Advance engineers bring to the lighting industry these new **"A"** QUIET-RATED fluorescent lamp ballasts that absorb the magnetic vibration of the core and coil before it becomes sound. This is a new concept that is only presently possible to achieve with the use of a special THERMO-PLIABLE COMPOUND. These new ballasts also incorporate the exclusive Advance "KOOL-KOIL" principle. They operate cooler, give up to 15% more light output and increase ballast life 3½ to 4 times over ordinary ballasts.

For silent lighting installations in schools, hospitals, libraries and other critical areas where absence of noise is the primary consideration, specify ADVANCE **"A"** QUIET-RATED fluorescent lamp ballasts. Catalog No. RQM-2S40 for 118 V. operation. Catalog No. VQM-2S40 for 277 V. operation.

"The Heart of the Lighting Industry."

Mfg. in Canada by: Advance Transformer Co., Ltd. 5780 Pare St., Montreal, Quebec.

ADVANCE®

CBM CERTIFIED

World's Largest Exclusive Manufacturer of Fluorescent Lamp Ballasts

TRANSFORMER CO.

2950 NO. WESTERN AVE. CHICAGO 18, ILL. U.S.A.

FREEZING RAIN CONDITIONS were maintained in large university's Climatometer until an ice coating averaging 3/4 inches was deposited on all horizontal surfaces of Type WAG 230 kv switch shown here in closed position. Similar tests were conducted on switches in open position.

WHEN ICE HITS... WHAT HAPPENS

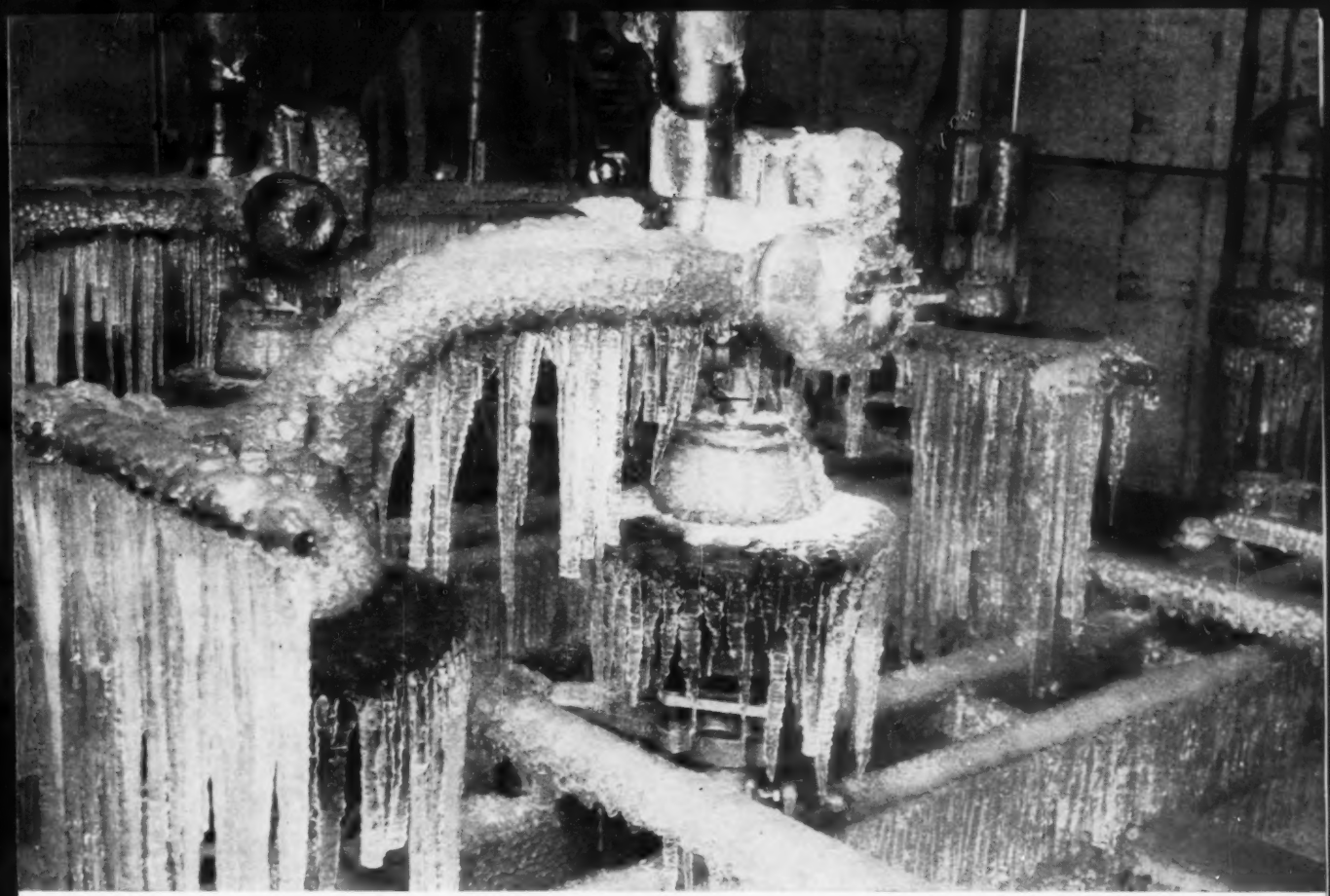
When heavy icing occurs, will you still be able to open or close your air switches?

This is a question getting increasingly careful attention from engineers . . . both those who design such switches and those who apply them.

Horizontally mounted vertical break switches in the higher voltages present the greatest problem. The switch blade is long and a lot of ice can accumulate. For example a one-inch layer on the blades of a 230 kv, 3-pole switch of this type weighs approximately 132 pounds. Translate this into the extra effort required to open the switch and it comes to 2640 pound inches or 77 pounds on a 36″ swing handle. Adding further to the difficulties is the inherent design of the switch. Contacts are difficult to shield. When switch is closed, ice accumulates on the contact assembly. When open, the contact shoes become ice coated, making it necessary to chop the blade into the closed position under heavy impact.

Why do we point out such hazards to you?

For one thing we know that our Type WAG can handle the problem. We have tested it under severe icing conditions, and it can be opened or closed by the efforts of one man.

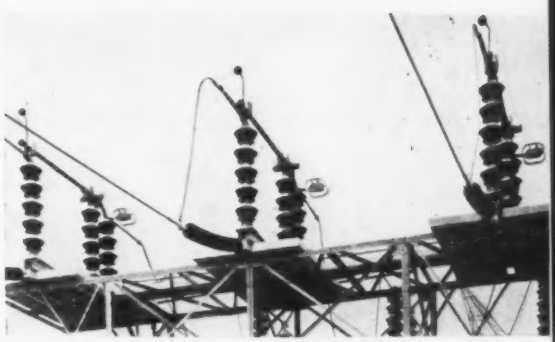


3-POLE SWITCH IS OPENED by the efforts of one man. Heavy weight of ice required extra effort, but switches were fully opened and were in operative condition after each test.

TO YOUR AIR BREAK SWITCHES ?

The reason for the WAG's good performance under ice is simple: engineering and construction. The relationships of all moving parts are such that ice formations are in shear or tension. Force transmitting linkages are well-protected from ice accumulation. And all moving members are rugged enough to prevent deformation when the switch is forced open or chopped into the closed position.

Southern States Type WAG will operate effectively under ice and other adverse operating conditions. For complete details, contact your Southern States representative or write us for Bulletin 59 WAG.



Baltimore Gas & Electric Company uses Southern States 230 kv, 1200 ampere WAG Switches as OCB disconnects on its Northwest substation, seen in the above photograph.

SOUTHERN STATES EQUIPMENT CORP.

HAMPTON, GEORGIA

IN CANADA: Dominion Cutout Co., Ltd., Toronto

A cool, clean electric kitchen is included in the purchase price of every Medallion Home

This is Mrs. C. R. Campbell of Fullerton, California, in her all-electric Medallion kitchen

MEDALLION HOME
LIVE BETTER ELECTRICALLY

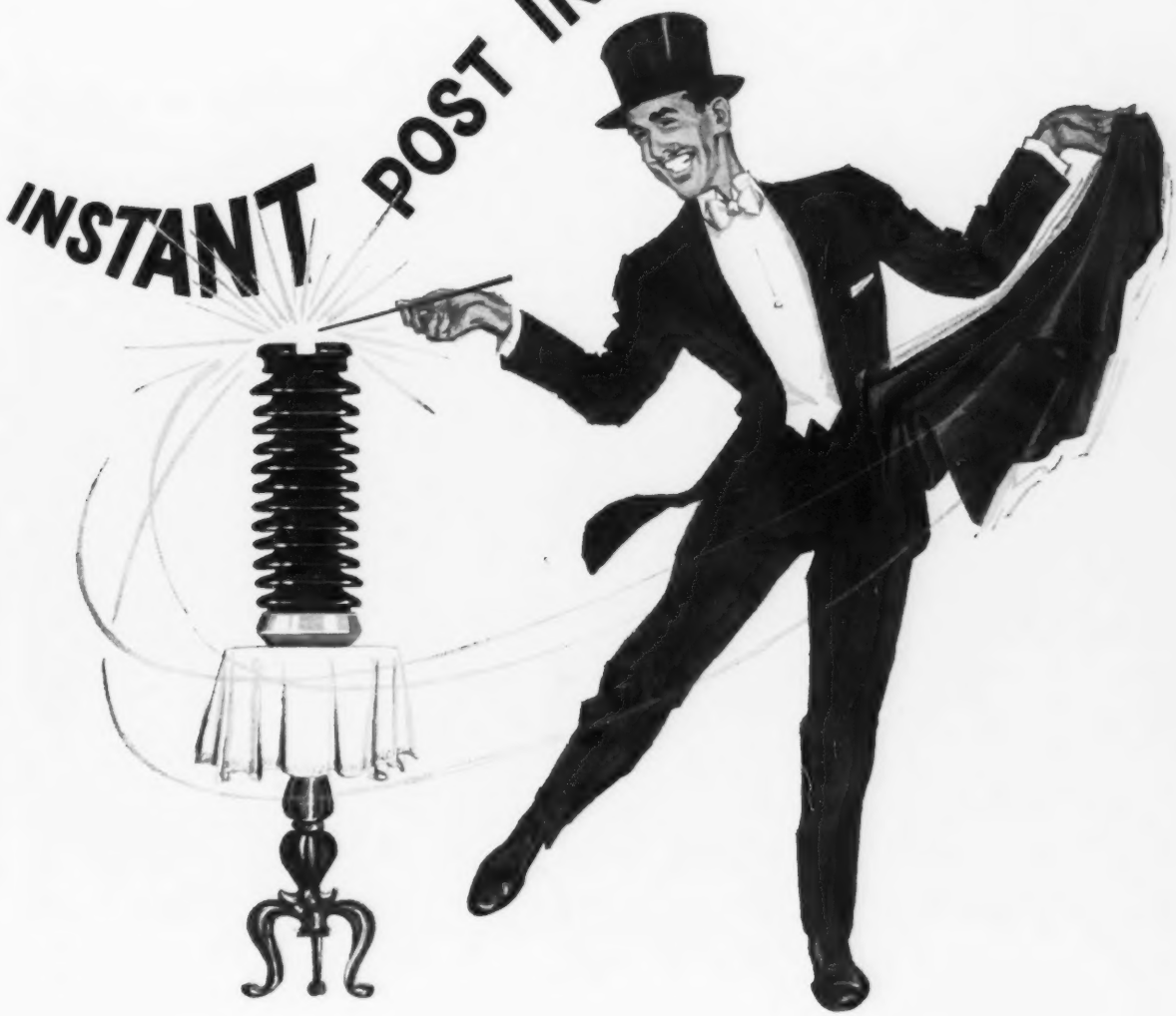
Help for wives: An all-electric kitchen is at your service the moment you move into your Medallion Home. The latest range-and-oven gives you a *clean* helping hand, important free minutes, a kitchen climate that's 16° cooler. And your Medallion Home affords the creative lighting you've always wanted — assuring you comfort, beauty, safety.

Savings for husbands: The appliances in the all-electric kitchen of your Medallion Home are already taken care of in the basic home cost. And your home is thoughtfully planned for full Housepower — wired for tomorrow's power needs as well as today's. Further, a Medallion Home is a *wise* investment. For, in a future that's all-electric, your Medallion Home will remain electrically modern.

Beyond all this is the Gold Medallion Home — the ultimate in living better with electricity. It's completely electric. And you have a wide choice of new electrical home-heating methods. One is the amazing electric heat pump... it *cools* your home without water, *heats* your home without flame.

SOUTHERN CALIFORNIA Edison COMPANY *helps you* LIVE BETTER—ELECTRICALLY

INSTANT POST INSULATORS ?



Not yet. Lots more to it than "Let's get into the Line Post and Station Post business." Yet as more and more power companies standardize on Lapp's better insulator design, more and more imitations crop up.

Pretty good copies, some of them—in looks. Funny thing, though, you don't see many around. Partly because they couldn't copy the most important thing: Lapp's 30 years of taking out the bugs, putting in the failure-free performance characteristics.

Your only reasons for specifying Line Posts and Station Posts on your systems are for fewer interruptions of service, lower maintenance and replacement costs. Makes sense to get them from the company that pioneered, proved and perfected them.

Lapp

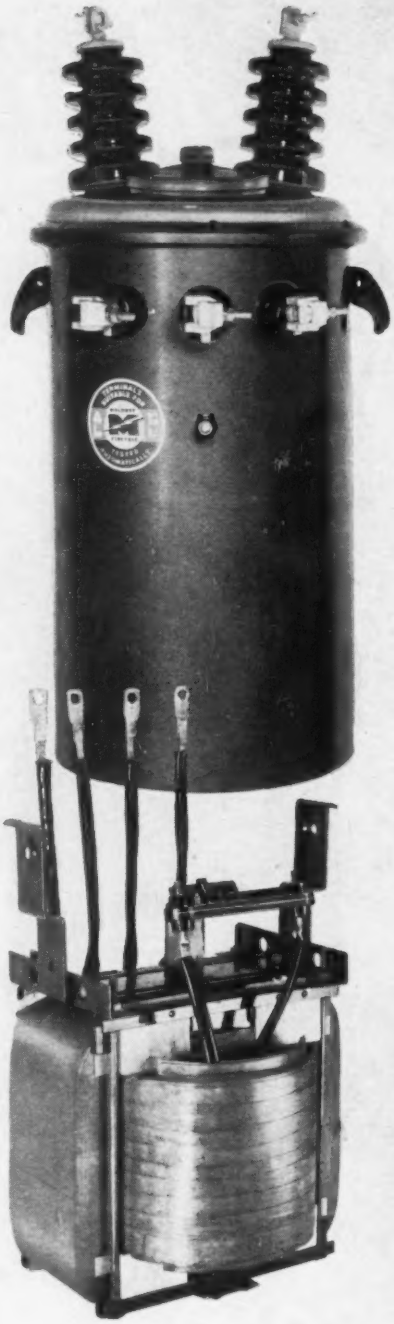
New Lapp Catalog Eight tells lots about Line Posts and Station Posts. Write for your copy.
Lapp Insulator Co., Inc., Le Roy, New York.

HAVE YOU A NOSE FOR NEWS?

Here's a scoop about the new

MOLONEY

Distribution Transformer



New features have been designed into the New Moloney Distribution Transformers. Compare these new transformers with competitive units. Decide for yourself where you will get the most for your transformer dollar.

NEW DESIGN FEATURES

1. New deep-drawn crowned cover—Smooth, rounded surfaced readily shed moisture and eliminate places where corrosive material can accumulate. The distance from the crown of the cover to the clamping band has been increased. This, when combined with the new Duracoat* Insulation, provides maximum protection against outages due to birds and other wildlife.

2. New cover internally grounded and positioned—(For Duracoat* Covers). A captive phosphor-bronze spring positions and automatically grounds the insulated cover to the tank, to prevent radio-frequency interference and eliminate shock hazards to linemen.

3. New cover clamping band—Designed to exert uniform pressure around the entire circumference of the cover. Clamping is done by a stainless steel bolt whose swinging hinge action permits ready removal of the cover. There is no chance of dropping parts of the clamp since all parts are captive.

4. New moisture shedding weep openings—Numerous weep openings are formed at intervals around the clamping band. These weep openings are so designed that water cannot be trapped in the band.

5. New single bolt handhole cover—Facilitates easy entry into the tank. Uniform pressure is exerted on the corprene sealing gasket by a captive internal bar.

6. New contour lifting hooks—Smoothly contoured hook underside prevents sling abrasion. Designed to permit use of cable or rope slings even on the smallest transformers without damage to bushings.

7. New hercules tank rim—Greater strength for tank top rim is obtained by rolling approximately 400 degrees. This increased resistance to distortion permits retention of the proved Moloney gasketing method.

8. New three-point core-and-coil suspension—Prevents pressure contact of Core-and-coil assembly with the tank bottom and thus achieves a reduction in sound level.

9. New high strength frame design—Maintains the superior eight-point blocking system for resistance to short circuit distortion.

10. New steel banded palletized unit—A steel band connected to the lifting hooks secures the transformer to the shipping pallet and thus facilitates handling by fork lift trucks.

11. New protective enclosure—Pre-tested and proved to be of great strength, the enclosure permits stacking. Easy to strip away when the transformer is to be installed, leaving only the palletized transformer.

PLUS THESE RETAINED SUPERIOR FEATURES

The Superior Moloney Core with inherently low exciting current —low core loss—low sound level • Low impedence design, resulting in improved voltage regulation • High short-circuit strength • High impact strength—liberal creepage bushings • Electro-tin coated connectors large enough to accommodate AL-CU conductors • Triple-thick tank bottom rim • Patented, automatic, electronic testing.

COMPARE COMPARE

So that you may decide for yourself . . . examine the design of new improvements . . . review the features which were retained . . . compare all of the advantages of Moloney Transformers with competitive units. You will agree that these new improvements—combined with features that have been retained . . . add up to the best total value for your transformer dollar.

ME61-1

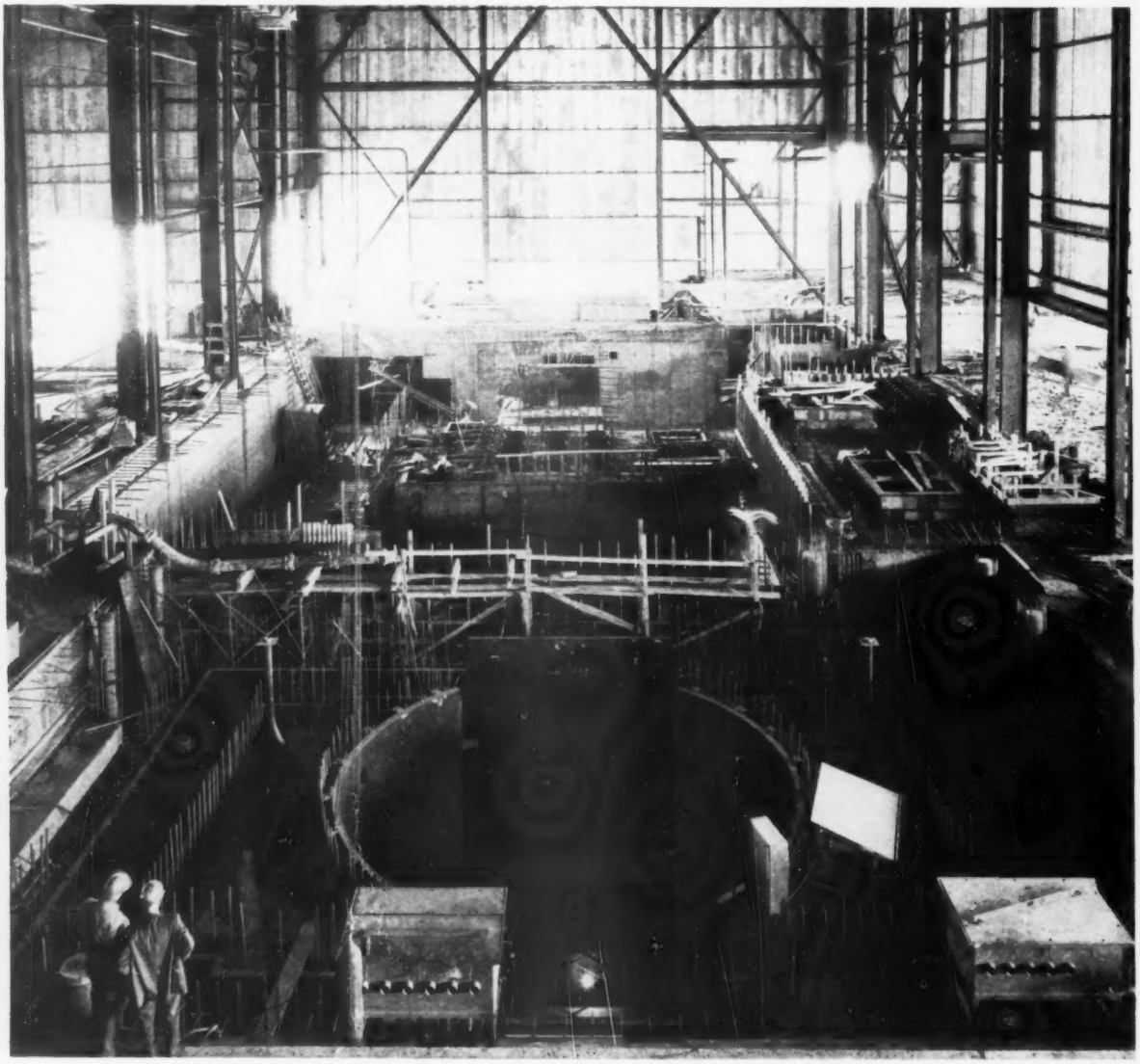
Since 1896 . . . MORE POWER TO YOU

Manufacturers of Transformers for Utilities, Industry, and Electronic Applications

MOLONEY ELECTRIC COMPANY

FACTORIES AT ST. LOUIS 20, MO., AND TORONTO, ONT., CANADA
SALES OFFICES IN ALL PRINCIPAL CITIES

75,000 KW Sodium Graphite Reactor station for Consumers Public Power District at Hallam, Nebraska



The Peaceful Atom

Helping the world double its power supply in the next ten years

The fuel of the future is in the atom. But even now, lights are burning, wheels are turning, thanks to atomic fuel. Atomics International, a world-wide leader in advanced, high-performance reactor systems, has over 15 years' experience in designing, constructing, and operating reactors. Two of the world's most advanced atomic power stations are now being built by AI under AEC programs. The wealth of experience and facilities at Atomics International will help the world's power-producing companies in their plans to double the supply of electricity in the next ten years.

ATOMICS INTERNATIONAL

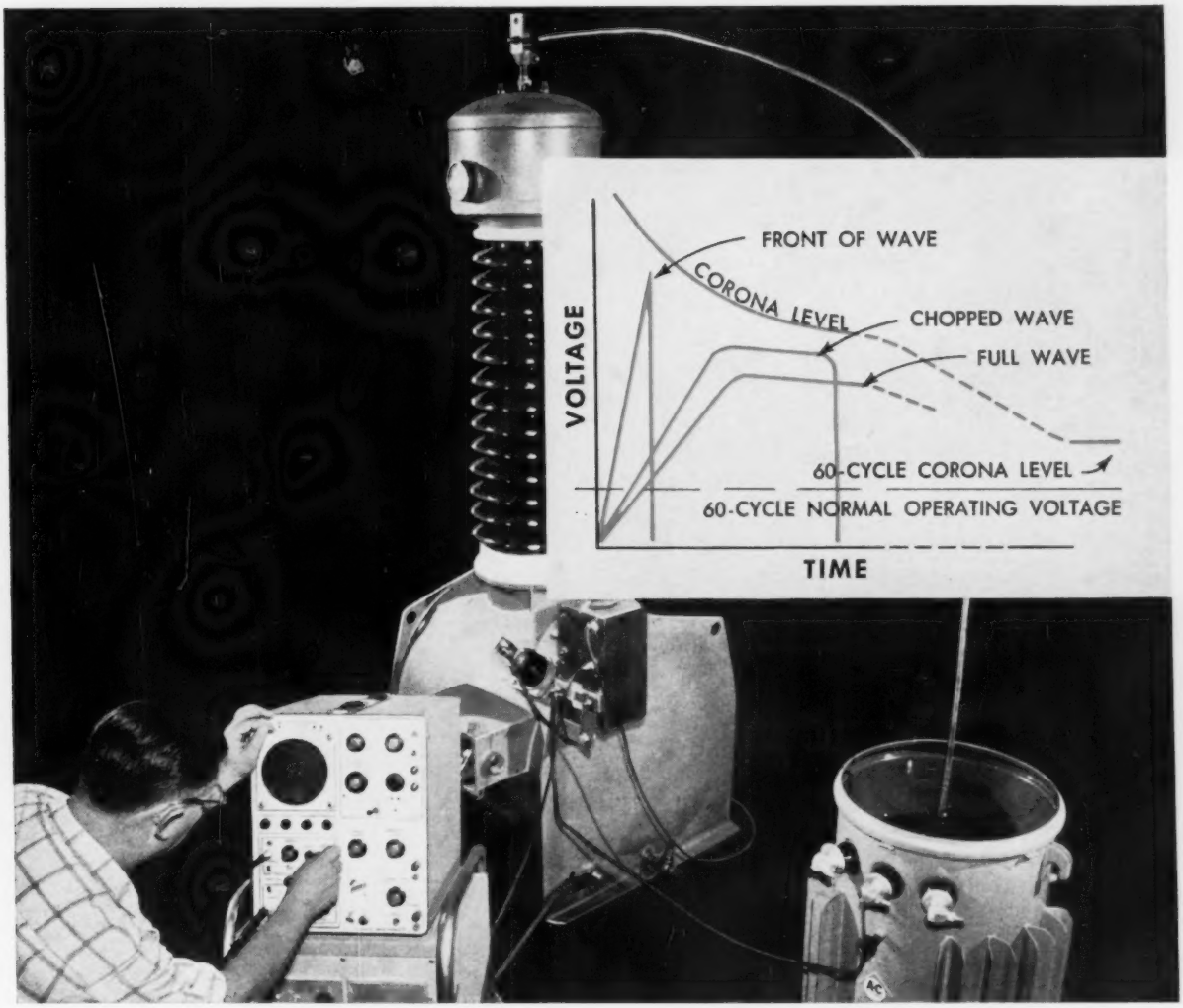
Division of North American Aviation

Pioneers in the creative use of the atom

World Headquarters: Canoga Park, California, U.S.A. Cable Address: ATOMICS. *Other offices:* Washington, D.C., U.S.A.; Geneva, Switzerland. *Affiliated with:* INTERATOM, Bensberg/Cologne, Federal Republic of Germany and DYNATOM, Paris, France

ALLIS-CHALMERS

A-1391



Proven corona-free design lengthens transformer life

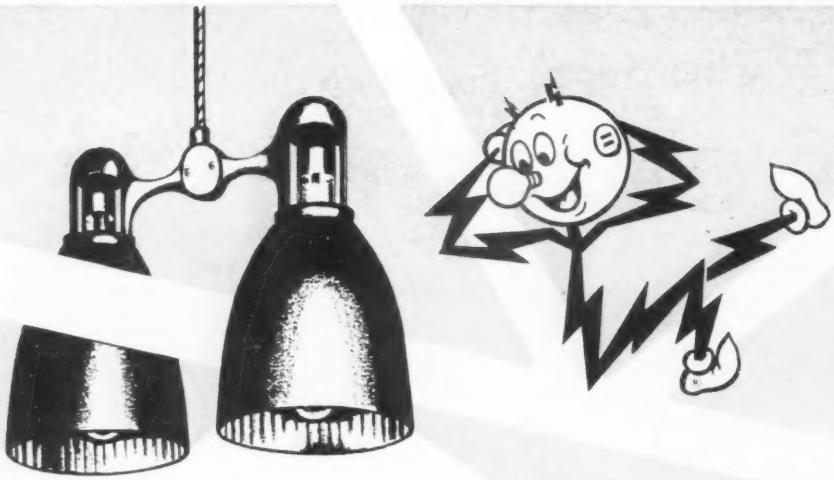
Allis-Chalmers transformer insulation (both winding and barrier) is designed (and proven by tests) to be *entirely free of corona*... not only at the operating voltage, but at *all test levels*. By use of superior measuring techniques and instrumentation, Allis-Chalmers engineers have established design criteria which bring this benefit to all A-C transformers from 5 kva through power transformers in the ASA standard range. Corona — the cancer of electrical equipment — is eliminated. The problems of carbonization of insulations and thermal breakdown of oil are substantially reduced.

Extensive studies on "compatibility" of insulations have also helped to increase transformer life. Through accelerated tests on many laboratory models and long-time tests on completed transformers Allis-Chalmers engineers have determined the ideal material combinations. Controlled processing to eliminate air and moisture lowers moisture content to as low as twenty parts per million.

Because of these three major factors . . . all A-C transformers in the above ratings built since January 1, 1960, are capable of delivering a twelve-percent increase in capacity at 65 C rise without loss of life.

• • •

For more information *about the additional built-in capacity of Allis-Chalmers transformers call your nearby A-C representative. Or write, Power Equipment Division,* **Allis-Chalmers,** *Milwaukee 1, Wisconsin.*



Reddy says:

MERCURY LAMPS SOLVE

HIGH-CEILING LIGHTING

PROBLEMS AT PYROMET!

Modern plants requiring unusually high ceilings are now killing shadows and throwing adequate light on work areas with color-improved, high-intensity mercury lamps. Case in point: Pyromet Company in San Carlos. Good lighting is vital here — where missile parts demand sharp visual inspection and accurate instrument reading. Mercury lamps — from a 23′ ceiling — make the job practically mistake-proof!

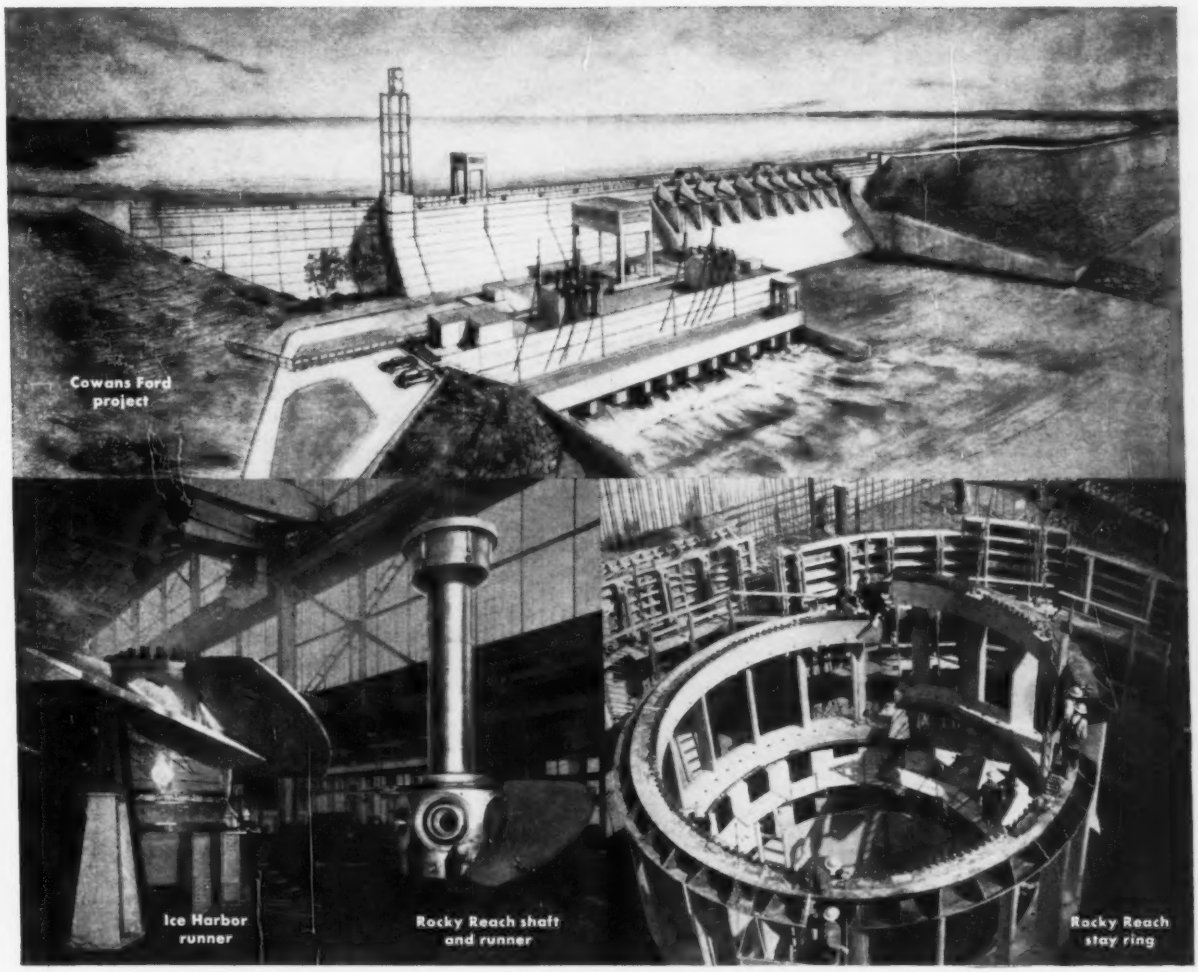
Estimated total hourly lighting cost (including depreciation) for Pyromet's 20,000 square foot plant? 3 cents per footcandle. Payoff? Increased production, less rejects, fewer accidents, higher morale. Get more facts on mercury lighting from your nearest PG&E office now!

NORTHERN CALIFORNIA ELECTRICAL BUREAU
1385 Market Street, San Francisco.

this message sponsored by **P·G and E·**
Pacific Gas and Electric Company

NEW BOOKLET AVAILABLE:
"What's New in Well-planned Industrial Lighting" — free from Northern California Electrical Bureau or PG&E.

ALLIS-CHALMERS



high-head Kaplans for peaking

—previous record-breakers also by Allis-Chalmers

Cowans Ford is the outstanding illustration of Kaplan turbines used to provide peaking capacity. Duke Power Company, with Chas. T. Main Inc. as consulting engineers, has selected A-C Kaplan turbines for operation at 115-ft. head. Each of the three units is guaranteed to provide a maximum of 153,000 hp. Actual operation will involve only a short time each day, meeting peaking requirements of the system which is predominantly steam. The resulting average load factor, *less than 5%*.

KAPLAN RECORD-BREAKERS

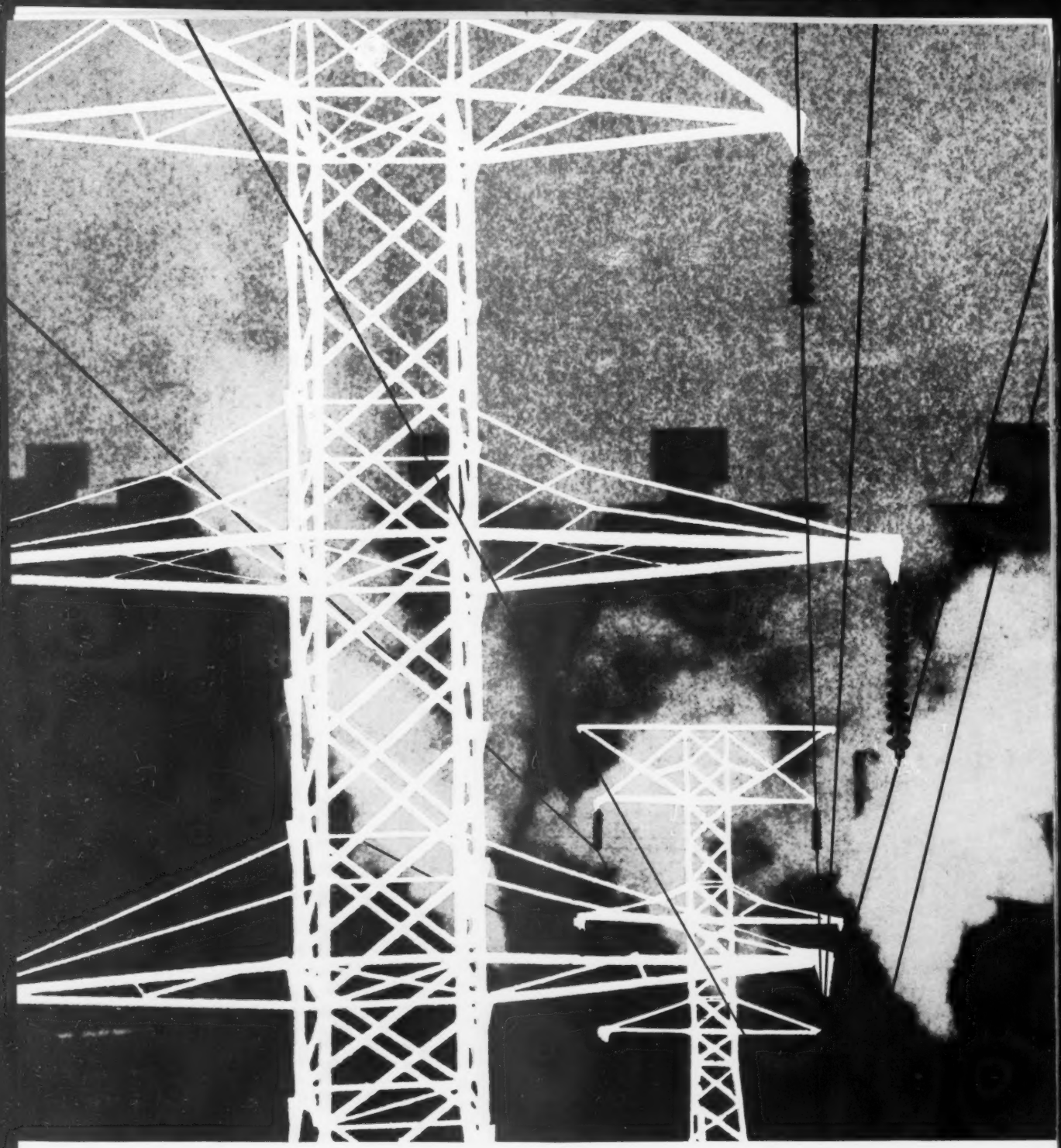
Cowans Ford—the third in a series of outstanding A-C Kaplan turbine installations. These units exceed those at both Ice Harbor and Rocky Reach in rated capacity and head. All are similar in construction (those at Cowans Ford are slightly smaller in physical size). Allis-Chalmers diversified experience to date includes over 240 Kaplan turbines — *a record 6 million hp.*

Rocky Reach—public utility district supplied with seven Kaplan turbines, each 140,000 hp (under 92-ft. head).

Ice Harbor — Corps of Engineers installation recently provided with three new A-C Kaplans for operation at 89-ft. head. These held the record with 143,000 hp per turbine until Cowans Ford.

In every facet of hydro generation, people count on record performance and experience from Allis-Chalmers. For assistance anytime, contact your local A-C representative or write to **Allis-Chalmers,** Hydraulic Division, York, Pa.

A-1383



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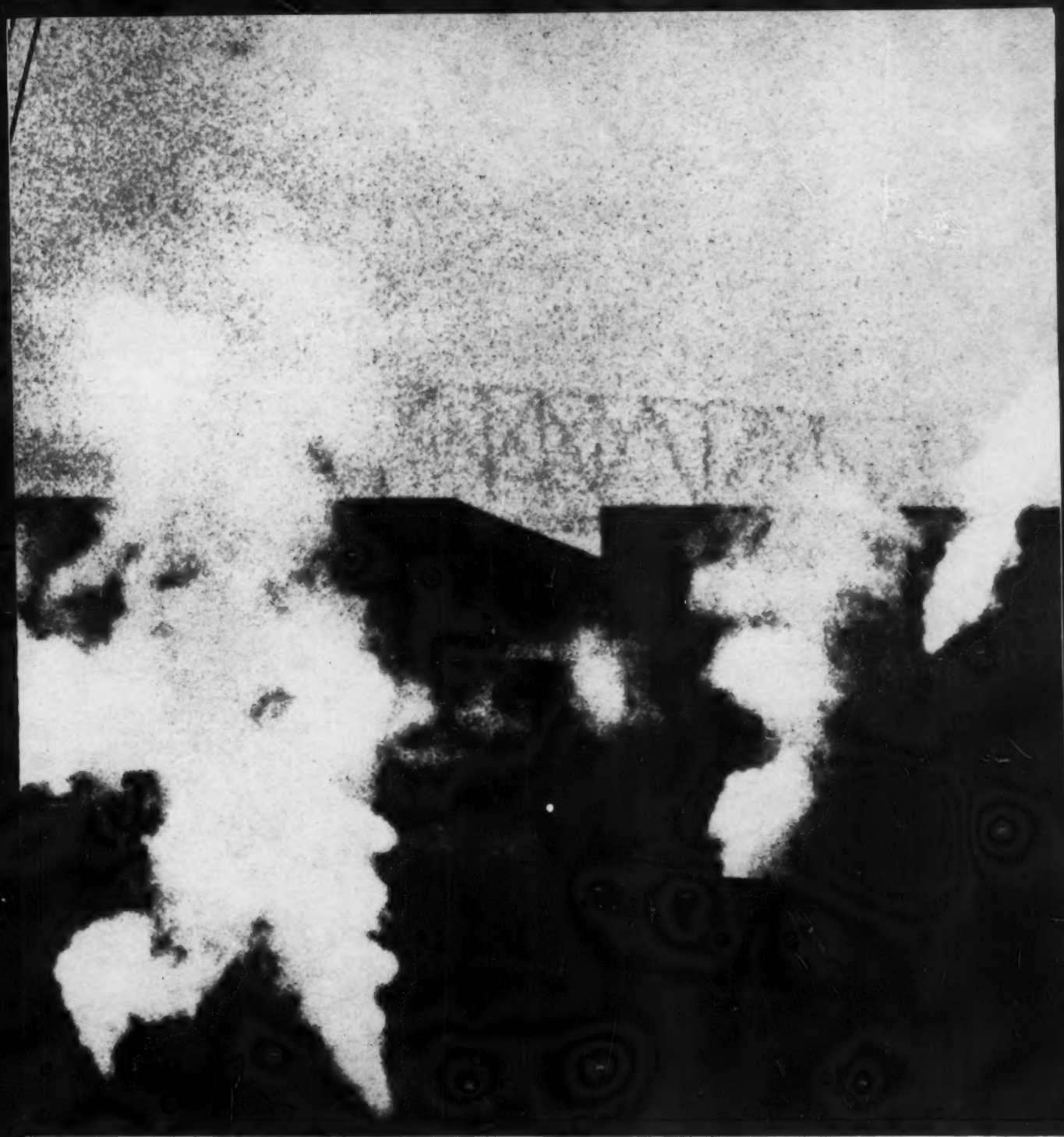

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LETTERS TO THE EDITOR

Likes Platform

To the Editor:

WOW! & AMEN!

If you can edge out Elvis Presley and run yourself in 1964 I'M FOR YOU! Like that '64 platform.

Dale H. Price
San Gabriel, Calif.

Spelling Slip

To the Editor:

How many letters have you received, telephone calls, needlings at the Engineer's Club and other mentions on the modernized spelling of the guy who passed some laws which have led us into mountains of simultaneous equations on electrical circuits —Kirchhoff?

Or, was that Kerkoff mentioned on p 2 of the December WEST really some other fellow?

I really am curious about the statistics—what proportion of your readers can't spell themselves but can tell whenever a printer tries to break tradition?

You know, I'm liking the looks of the WEST and the ARCHITECT more every issue.

Laurence E. Baty
Salt Lake City, Utah

More On Cost Saving

To the Editor:

The article "EHV Systems Can Be Economical" published in your August 1960 ELECTRICAL WEST has been called to my attention because of the emphasis placed on tower design as the principle means of reducing transmission line cost and the omission of the other areas of construction cost such as broken wire assumptions, conductor selection and conductor tension, which offer even greater opportunities for reduced capital cost.

Last winter in AIEE Paper No. 60-189, I described how 10% construction savings can be realized by the use of tighter conductor tensions. These savings are of two parts: those that follow the use of shorter or fewer towers due to the lesser sags; and those that result from the use of the cheaper, lighter steel cored ACSR conductor strandings which would become acceptable if higher everyday tensions did not result in conductor fatigue at support points.

This paper also pointed out the treatment of broken wire loads in the tower design has a major influence on the cost reduction if increased conductor tensions were to be considered.

The paper suggests that savings of 2.4 to 4.4% of total line cost are possible in shorter and fewer towers if higher conductor tensions were used on a 230-kv line in a densely populated area having 25% towers at line angles. Still greater savings in towers, foundations and insulators should be possible in EHV lines originating in remote areas where fewer line angles should be anticipated.

Savings in conductor material cost of up to $1,500 per circuit mile or possibly 5% of the total line cost are possible when the lighter cored ACSR strandings are adapted to the sags of its stronger alternate whose strength is not being utilized because of the limitation placed on its everyday tension to combat conductor fatigue.

It now appears from extensive laboratory tests of hundreds of millions of stress reversals at extended tensions (25, 35 and 40% of ultimate) that at least one manufacturer of accessories has a suspension support device which may now make it possible to realize the 10% savings contemplated in the paper. All those who are considering employing higher tensions should investigate this unique support device . . .

Eduard Fritz
Consulting Engineer
Washington, D. C.

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NEW Allen-Bradley Relay with EXCLUSIVE Permanent Magnet Latching

Saves Panel Space

Gives Millions of Trouble Free Operations

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Two to Six Poles

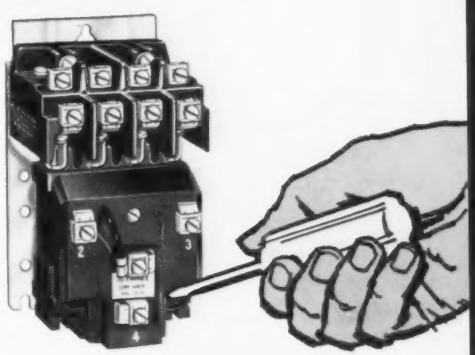
Bulletin 700 TYPE BRM

Here's a completely new "latching" relay—which does not use a mechanical latch! It is the Bulletin 700 Type BRM—built to provide the same millions of dependable operations you get from all Allen-Bradley's industrial relays. A "built-in" permanent magnet eliminates the mechanical latch and the usual troubles caused by mechanical linkages.

When the coil of the new Bulletin 700 Type BRM relay is energized, the relay closes and is held closed after the coil circuit is opened—by a permanent magnet. Energizing the coil in opposition to the permanent magnet field opens the relay. The correct polarity for operation of the relay is obtained from silicon diodes held within the molded coil cover. With no "piggy-back" additions out in front, and no "extra" solenoids below, the Type BRM relay saves valuable panel space.

These A-B Type BRM relays also feature a continuous duty coil that permits the current to be left on, if desired. As with all Allen-Bradley relays, the double break, silver contacts never need attention. And the contacts of these new magnetically latched relays afford the same 60-second convertibility of the popular Bulletin 700 Type BR relay.

For latching relay service, it will pay you to investigate this new and completely different relay. It provides the usual Allen-Bradley quality!



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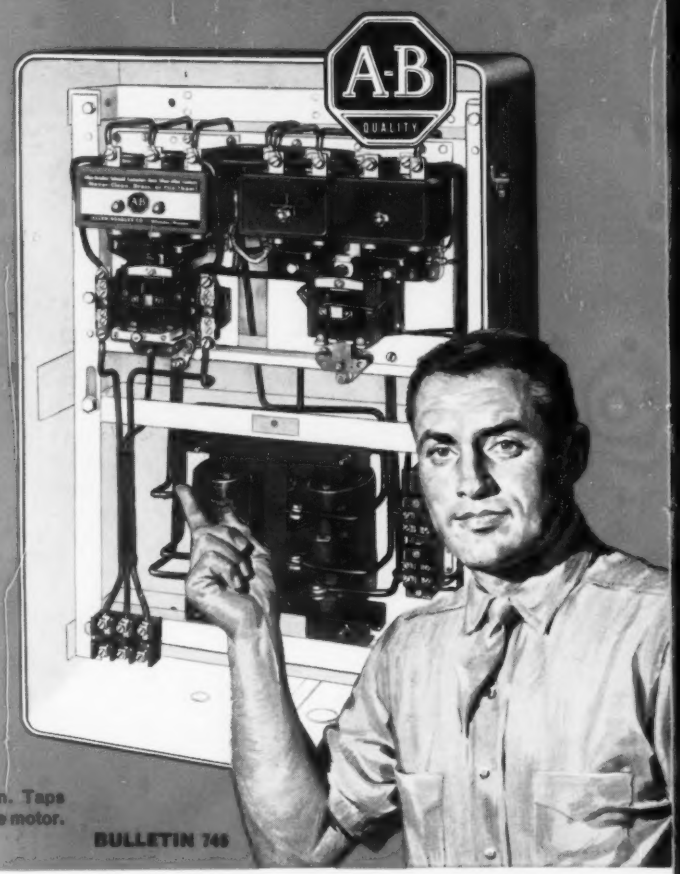
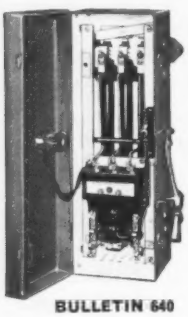
Allen-Bradley has the best and most complete answer

No matter what your reason for reduced voltage motor starting may be, Allen-Bradley has the *right* starter. Not only can the power company's requirements be satisfied exactly, but the A-B starter will at the same time provide the best possible starting conditions for the motor and the driven load. At least one of the starters described below will completely satisfy your operating requirements. For more detailed information, send for Publication 6088.



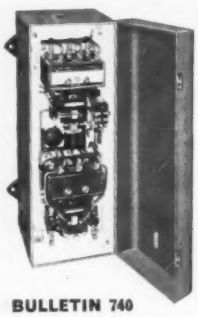
AUTOMATIC AUTOTRANSFORMER starter for squirrel cage motors that should not be started at full voltage. The autotransformer reduces line voltage during acceleration. Taps permit adjustment of voltage applied to the motor.

BULLETIN 748



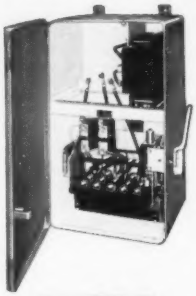
MANUAL STEPLESS RESISTANCE starter has graphite compression disc resistors for velvet smooth starting of squirrel cage motors. Starting of the motor is under the complete control of the operator.

BULLETIN 640



AUTOMATIC RESISTANCE starter has graphite resistors automatically inserted in series with the squirrel cage motor at starting. Resistors can easily be adjusted to motor and load conditions, giving velvet smooth acceleration.

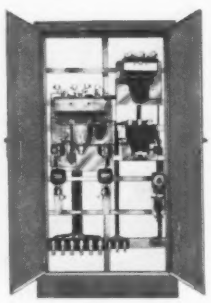
BULLETIN 740



MANUAL AUTO-TRANSFORMER starter for use where load conditions or power company rules require reduced voltage starting. The air break starter shown has double break, silver alloy contacts.

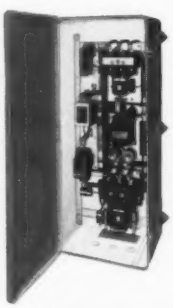
BULLETIN 646

AUTOMATIC MULTIPOINT RESISTANCE starter for use on network systems. Resistors inserted at starting are cut out in definite steps. Time intervals adjustable to provide velvet smooth starting.



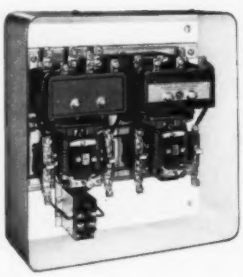
BULLETIN 741

AUTOMATIC STEPLESS RESISTANCE starter is not equalled for velvet smooth motor acceleration. It will satisfy any power company requirement. Eliminates lamp flicker on networks used for power and lighting.



BULLETIN 742

AUTOMATIC PART WINDING starter for use with squirrel cage motors having two separate parallel windings. Made in two-step type, and three-step type with resistance connected in the line on the first step.



BULLETIN 736

2-61-RM

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QUALITY MOTOR CONTROL

Meetings Calendar

JANUARY

12-13—*NRECA* Workshop VI on Managing the Member Education Power Use Program, Seattle City Light Auditorium, Seattle.
15-20—*Los Angeles Winter Market.*
23-27—*San Francisco Winter Market.*

FEBRUARY

2—*Intermountain Electrical Assn.*, annual conference, Hotel Ben Lomond, Ogden, Utah.
5-7—*Power & Communication Contractors Assn.*, 15th annual convention, Sir Francis Drake Hotel, San Francisco.
5-11—*National Electrical Week.*
11—*Snake River Valley Electric Assn.*, annual conference, Boise, Idaho.
21-22—*Rocky Mountain Electrical Manufacturers Representatives Club*, third Electrical Exhibit, Convention Hall, Denver-Hilton, Denver, Colo.
23-25—*British Columbia Electrical Inspectors Assn.*, annual convention, Hotel Astor, Burnaby, B. C.

MARCH

20-25—*NWPPA/OSC* Meter School, Oregon State College Campus, Corvallis, Ore.

APRIL

5- 7—*Northwest Public Power Assn.*, annual meeting, Wenatchee, Wash.
5-9—*Electrical Maintenance Engineers Assn. of Northern California, Electrical Industry* Show, San Francisco.
6-7—*Pacific Coast Electrical Assn.*, Engineering & Operating Section, Ambassador Hotel, Los Angeles.
16-18—*Rocky Mountain Electrical League*, spring conference, Harvest House, Boulder, Colo.
17-18—*PCEA*, Business Development Section, Sheraton-Palace Hotel, San Francisco.
21-26—*San Diego Bureau of Home Appliances*, Electric Bldg., Balboa Park, San Diego.
26-28—*Northwest Electric Light & Power Assn.*, Engineering & Operation Section, Personnel & Safety Section, Purchasing & Stores Committee, Sheraton-Portland Hotel, Portland.
26-29—*National Electrical Contractors Assn.*, Tri-District meeting, Hotel Fairmont, San Francisco.
27-28—*PCEA*, Administrative Services Section, spring conference, Villa Hotel, San Mateo, Calif.

MAY

1-2—*Illuminating Engineering Society*, Intermountain Region Conference, Hotel Utah, Salt Lake City.
3-5—*IES*, South Pacific Coast Region conference, Sacramento Inn, Sacramento.
8-9—*IES*, Pacific Northwest Region conference, Harrison Hot Springs, Harrison, B. C.
17-19—*Pacific Coast Electrical Assn.*, annual conference, Sheraton-Palace Hotel, San Francisco.

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news EW

Two 500,000-v Transmission Lines Proposed in Zinder Report on California-Northwest Tie

The Stage 1 Progress Report to the State of California on the California-Pacific Northwest Interconnection by H. Zinder and Associates proposes the construction of two 500,000-v transmission circuits from The Dalles and John Day Dams on the Columbia River south through Oregon to Bakersfield in California. Connections to existing 220,000-v transmission would be provided at Redmond and Klamath Falls in Oregon and at Shasta Dam, San Francisco Bay area, Fresno and Bakersfield in California.

Maximum capacity of the two circuits would be 2,000,000 kw but the firm capacity rating of the interconnection is considered to be 1,600,000 kw and would be reliable up to that amount without spinning reserves to back it up.

The transmission circuits including substations, but not including cost of system reinforcements either in the Northwest or California, are estimated to cost $200 million. Financing of the facilities was assumed to be undertaken by a cooperatively owned nonprofit corporation in Oregon, which would pay state and local taxes but not federal, through the sale of revenue bonds. In California financing and construction was assumed to be undertaken jointly by municipally owned electric systems or the State of California or both, which would pay no taxes, also through the sale of revenue bonds.

Revenue to finance the sale of bonds would be derived from the sale of power in California as follows:

1. 1,000,000 kw of peaking power available at approximately 40% capacity factor.
2. 250,000 kw of peaking capacity available through load diversity in the region.
3. Reserve capacity of 187,000 kw to back up the 1,250,000 kw listed above.
4. Sale of available surplus dump energy up to the full 2,000 mw capacity of the interconnection.

The 1,000,000 kw of peaking power would be obtained from a 300,000-kw coal fueled steam electric plant located near Cle Elum, Wash., and the remainder, including reserves, from presently installed surplus hydroelectric capacity without cost in the Pacific Northwest. In an adverse year in the Northwest, the 3,570 million kwh of energy required to support the million kw of capacity would come from the following sources: 2,070 million kwh from the Cle Elum steam plant, 896 million kwh from surplus hydroelectric resources and 604 million kwh from offpeak thermal generation in California. In an average water year in the Northwest, 7,114 million kwh of surplus hydro and 1,426 million kwh of steam-electric generation would be delivered to California. By using the full two million kw capacity of the interconnection 14,906 million kwh of surplus hydrogeneration would be delivered to California in a good water year in the Northwest. This surplus energy was assumed to be available without cost. The Cle Elum steam plant generation would not be required in such a year and would presumably shut down.

The economic analysis shows that with power sold at the points of interconnection for $15 per kw a year and four mills per kwh, and with no charge for surplus hydroelectric capacity and energy in the Northwest, the transmission line could be amortized in 10 years and a surplus of $12 million annually would be available to reduce power costs in California and increase revenue in the Northwest.

NEWS INDEX

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In its "findings" the report lists many other accomplishments and benefits of the interconnection, some of which are overlapping or mutually exclusive. **Neither the line capacity nor the supply of Pacific Northwest surplus power and energy is great enough to meet all objectives.**

The Pacific Gas and Electric Co. has indicated that it cannot use the low capacity factor peaking power in its area because it has the same general characteristics as the by-product hydroelectric power from federal, state and local agency water resource development in northern and central California.

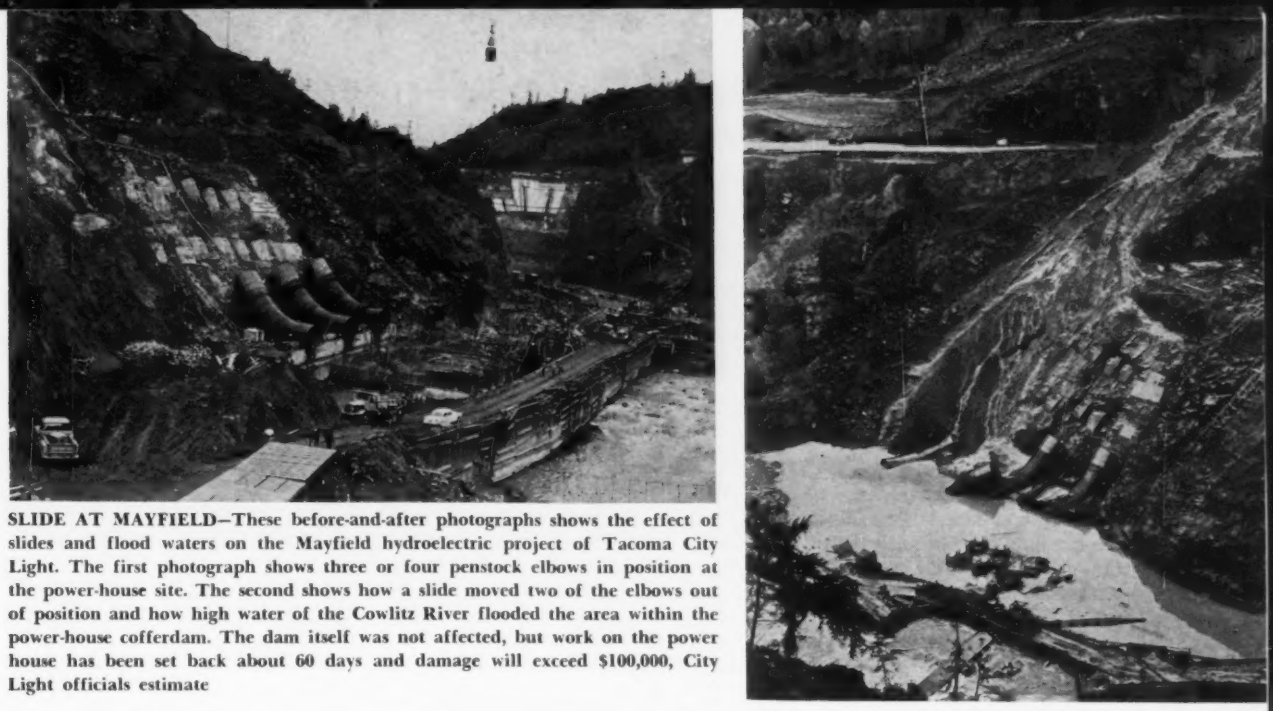
PG and E also states that approximately two billion kwh annually is the maximum amount of surplus dump energy it could absorb without adverse effect on local hydroelectric projects or gas and oil commitments required to assure a firm economic supply. The report is silent on the effect of energy imports, which vary from 6.2 billion kwh to 14.9 billion kwh annually, on the fuel supply commitments and contracts in California.

The report states "it does not appear to be necessary to use Pacific Gas and Electric Co. loads in this report to demonstrate a market for power from the interconnection." However, a power flow diagram in the report shows 1,772 mw flowing into California over the two circuits and only 700 mw of this amount flowing to southern California.

Bids on Flaming Gorge

Region Four of United States Bureau of Reclamation has announced bids were recently received on construction of the first link of the "backbone" power line system for Flaming Gorge Dam — 41 miles of 138-kv line were bid on.

The line will start near the proposed switch yard at the dam site and extend south to Vernal substation in Uintah County. Ultimately, it will go southeast to Rangely, Craig, then to Oak Creek, Colo. An H-frame wood pole design has been specified, with 270 days allowed to complete the project.



SLIDE AT MAYFIELD—These before-and-after photographs shows the effect of slides and flood waters on the Mayfield hydroelectric project of Tacoma City Light. The first photograph shows three or four penstock elbows in position at the power-house site. The second shows how a slide moved two of the elbows out of position and how high water of the Cowlitz River flooded the area within the power-house cofferdam. The dam itself was not affected, but work on the power house has been set back about 60 days and damage will exceed $100,000, City Light officials estimate

Four Corners Project Gets Green Light

The Four Corners mining and power project near Shiprock, N. M., was officially approved in Washington, D. C., Dec. 14 by Acting Secretary of the Interior Elmer F. Bennett. Included in the department's approval were Utah Construction & Mining Co.'s plan of development and operation of the 24,000 acres of coal-bearing lands that it holds under lease from the Navajo Tribe, and the plant site lease and power supply agreement between the Navajo Tribe and the Arizona Public Service Co.

The action was the final step required to enable Arizona Public Service Co. to proceed with construction of its big power plants, which initially are for a generating capacity of 350,000 kw representing a capital investment, including transmission lines, exceeding $100 million. An engineering and construction contract with Ebasco Services Inc. and a separate construction contract with Utah Construction & Mining Co. have been negotiated, and work on the diversion facilities to provide water from the San Juan River is expected to commence immediately as the first phase.

Fuel for the new plant, which at full load will consume approximately 4,200 tons of coal each 24 hours, is to be supplied by Utah Construction & Mining Co. under a long-term contract with Arizona Public Service Co. Power is scheduled to become available by June 1963.

► A 10% increase in Sacramento Municipal Utility District electricity rates probably will have to be made in 1962, SMUD's chief engineer and general manager, Paul E. Shaad, has announced.

Shad told directors of the district it will not be necessary to boost rates in 1961 as previously had been predicted by the SMUD staff but financial forecasts, he emphasized, show clearly about 10% additional revenue will be required effective with the first bills sent out in 1962.

SMUD can put a rate increase in effect by action of its board of directors. Private utilities must get approval of the California Public Utilities Commission.

Asotin PUD Defeated

The decisive defeat Nov. 8 of a proposal to form a public utility district in Asotin County, Wash., by a margin of more than three to one demonstrated again that when an investor-owned utility presents the facts of its case to the people it will get their overwhelming support. Washington Water Power Co. decided to take its case directly to the people when the PUD proposition was placed on the ballot in Asotin County, where WWP has 4,560 electric customers and 3,632 water customers. The results—4,029 to 1,260 against the PUD—were even more favorable than the most optimistic prediction at WWP.

"The result in the Asotin County PUD election again clearly demonstrates that when people know the facts they will want and support utility ownership by investor-owned companies," George M. Brunzell, WWP president, said.

George Brunzell, WWP president, and William A. Lowry, residential sales supervisor for the company, talk over the Asotin County PUD election. Lowry was on the scene to direct the door-to-door campaign

► Two sections of the Associated Colleges of Claremont in Claremont, Calif., have been selected to conduct the **1961 summer economics fellowship program** sponsored by the **General Electric Foundation** for high school teachers. Claremont Graduate School and Claremont Men's College will administer the six-week, all-expenses-paid program for 50 outstanding social studies teachers from public and private schools.

PP&L Buys Wyoming Properties

Purchase of Southern Wyoming Utilities Co. of Rock Springs and the 20,000-kw electric generating plant of Union Pacific Coal Co. has been announced by Pacific Power & Light Co. Purchase price for the facilities was $3.2 million.

The transfer is subject to approval of the Wyoming PSC and other regulatory bodies that may have jurisdiction.

Southern Wyoming Utilities, a subsidiary of the Union Pacific Railroad, has approximately 5,900 electric customers in Rock Springs, Green River and Hanna and about 4,200 water customers in Rock Springs, Green River, Reliance and Superior.

D. R. McClung, Pacific Power & Light president, said adequate power would be made available to the Green River-Rock Springs area for future industrial development.

Southern Wyoming Utilities' facilities will be interconnected with Pacific's lines.

Merger Approved

Official approval has been given by the Public Utilities Commission for the merger of Waiahi Electric Co. Ltd. with the Kanuai Electric Co. Ltd. The order was made effective at the close of business Sept. 30.

Stockholders of both firms have approved the merger. The combined firm will be known as Kauai Electric Co., and all personnel of both firms will be absorbed into the reorganized firm.

► The Pacific Marine Fisheries Commission, made up of fishery directors of Oregon, Washington and California, voted unanimously at close of a three-day annual meeting at Portland, Ore., to ask Congress to set aside the Salmon River in Idaho as a fish sanctuary. The resolution opposed construction of Nez Perce Dam on the Snake River as well as proposed dams at Lower Canyon, Crevice and Freedom sites on the Salmon. The advisory committee of the interstate compact group had first voted to recommend a resolution favoring construction of the High Mountain Sheep project sought by Pacific Northwest Power Co. as the "lesser evil" for fisheries of the two contested Snake River projects. But protests from fisheries interests of all three states swung reconsideration and the proposed resolution never came before the full commission.

THE STORY OF A HALF-CENTURY of electric living progress and how Pacific Power & Light Co., Portland, Ore., grew from a utility serving 10,000 customers in two states in 1910 into a system serving 325,000 customers has been the theme for special supplements published by 42 daily and weekly newspapers in five Northwest states. Responsible for concepts and planning for the edition were J. H. Ferguson, left, PP&L news director, and R. K. Foley, advertising manager. Combined circulation exceeded 570,000

Gas Generation for Anchorage?

R. W. Beck & Associates, Seattle firm of consulting engineers, has been retained by the city of Anchorage, Alaska, to study three proposals of the Chugach Electric Assn. for gas generation of electric power.

One proposal calls for Chugach and two other REA units to install the first unit of gas generation in the Kenai oilfield. This first unit would supply the associations through 1964, with the city to get the first unit, with surplus power to go to the associations. Chugach then would install the second unit, as needed.

The third proposal calls for joint construction of generation and transmission facilities, in conjunction with other members of the South Alaska Power Pool.

Peak load requirements of 120,700 kw are estimated through 1970, necessitating installation of gas turbine units totaling 60,000 kw and an alternate transmission line. Cost of power delivered in Anchorage would range from $.0132 in 1961 to $.00874 in 1970 according to Erling Orwoll, Chugach manager.

Residential Underground Practices Survey

The AIEE insulated conductors committee has formed a task force under chairmanship of Carter Blankenburg of Southern California Edison to prepare a survey of residential underground practices.

Utility engineers interested in this timely subject are invited to write:

R. C. Blankenburg
Southern California Edison Co.
P. O. Box 351
Los Angeles 53, Calif.

Include your name, title and company affiliation and subjects that you would like included in the survey.

PG and E Putting $1,350,000 A Day Into New Facilities

In the 15 years since World War II, Pacific Gas and Electric Co. has invested $2,192,000,000 in new construction, James Moulton, vice president and executive engineer, told the San Francisco Electric Club last month. Three-quarters of this amount has been spent by the company's electric department, he said.

On Jan. 1, 1960 PG and E had more than two-fifths of California's electric generating capacity, both governmental and investor owned. With the year's additions, it has 5,608,000 kw installed capacity. Peak demand on the system, reached last July, was 5,130,000 kw. PG and E is the first operating electric utility company in history to serve a demand of more than 5,000,000 kw.

Turning to the future, Moulton said that $500 million will be spent in the coming 15 months to provide additional facilities. This amounts to the expenditure of $1,350,000 a day (excluding Sundays) or $165,000 every hour of an eight-hour working

day, he pointed out to the group.

In a 1956 talk before the club, it was estimated that demand in PG and E's service area would be 5½ million kw in 1961. "We have almost reached that area figure in 1960, a year ahead of the five-year projection," he said. "Looking ahead another five years, we now estimate the area load will be 7,700,000 kw in 1965, an increase of 40% over 1960.

Summer peaks are growing at a rate of more than 400,000 kw annually, he said, and in five years will be increasing more than 500,000 kw a year if the trend continues.

Financial Notes

► **City Light** set new records for the first nine months of 1960 in sales of electric energy and operating revenues, Supt. Paul J. Raver has reported to Mayor Gordon S. Clinton and the city utilities committee chairman, Paul J. Alexander. The financial report for the first three quarters of 1960 showed that operating revenues for the period amounted to $28,336,577 as compared with $26,792,001 in 1959, the last nine-month record.

► **Utah Power & Light Co.** has reported net income of $7,061,654, equal to $1.44 a share, for the first nine months of 1960. This compares with a net of $6,822,151, or $1.39 a share, for the first nine months last year.

► The FPC has approved the price and interest rate **Idaho Power** Co. of Boise, Idaho, will receive for its sale of $15 million principal amount of first mortgage bonds, due 1990.

Idaho Power will accept the joint bid of Kidder, Peabody & Co. and White, Weld & Co. to purchase the bonds for the price of 100.67% of principal amount, with an interest rate of 4⅞% per year.

► **Southern Nevada Power Co.** of Las Vegas, Nev., and **Elko Lamoille Power Co.** of Elko, Nev., have filed an application with the Federal Power Commission proposing the merger of the two companies with Southern Nevada the surviving corporation.

► The FPC has authorized **Sierra Pacific Power Co.** of Reno, Nev., to issue unsecured, short-term promissory notes in a principal amount of $6,000,000 outstanding at any one time.

Stewart Udall, Appointee for Interior Secretary, Stresses Moderation; Has Voted With the Liberals

When Stewart Udall takes command as Secretary of Interior, he has two announced plans for the department: "Invigorate and regenerate . . ." Beyond that, the peppy 40-year-old Arizonan makes few forecasts prior to taking office, although he has some strong convictions.

In rebuttal to the challenge that he might tend to ultraliberalism, he stresses the spirit of moderation. **His voting record, however, supports those who expect him to bring a record of political liberalism to his new post.** He is described as a political realist, who prefers to see some form of liberal legislation enacted, rather than holding out for unattainable theories.

The new administration might shift emphasis but not the basic direction of the Eisenhower administration's power policy, he indicates. "Senator Kennedy and I will make no attempts to exclude private participation in development of power resources," Udall said.

Nevertheless he is expected to promote more federal multipurpose projects in the West and is understood to be strong for federal transmission line construction. During his six years in the House of Representatives, he served on the house labor, interior and education committees.

He supported the high federal Hells Canyon Dam when it finally was defeated in the house interior committee and he has supported the much-debated Fryingpan-Arkansas transbasin water diversion project in Colorado.

The Electrical Workers Journal (IBEW) gives Udall a 27-1 favorable voting record on labor-related legislation during his tenure: a 10-0 favorable record during the 1959-60 term. And he also has a 20-0 favorable voting record from the National Rural Electric Co-op Assn. on its latest list of "legislation affecting rural electrification."

As for trimming fat from overstaffed departments, he has said: "There'll be no sacred cows in any department. If I find any overswollen bureaus they'll be cut down pretty fast."

On top policy matters, Udall said he had no ready answers.

"We'll have to promote both conservation and use of the nation's resources, taking a moderate approach settling any differences which exist between extremists in the conservation or big business camps," he said.

In matters concerning development and management of the nation's natural resources, particularly water, land and power the new secretary will be traveling familiar ground.

Of Mormon heritage, reared in northern Arizona regions bordering the Navajo and Hopi Indian reservations, he is familiar as an attorney with reclamation and power projects that have involved his home state.

One of the big projects that will affect the West will be Arizona's application before the Federal Power Commission to build a power dam at Marble Canyon on the Colorado River. This application is scheduled for hearing in February.

The application also covers dams at Bridge Canyon and Prospect Canyon. But these are being held back pending a decision on whether to build a high or low dam at Bridge.

Final decision in Arizona's lawsuit with California over use of Colorado River water and implementation of the Central Arizona Project for transporting that water as far south as Udall's hometown of Tucson also are expected during his tenure.

The crew-cut Tucson attorney retains the verve and combat aggressiveness that made him outstanding as a University of Arizona athlete and air force gunner in World War II. He is the son of the late Levi Stewart Udall who, until his death last year, was a member of the Arizona Supreme Court.

The new secretary was elected to Congress in 1954, matured in Arizona Democratic ranks and last year wrested control of the party from old-guard members and delivered the state's Democratic nomination backing to Kennedy.

Arizona went Republican in the general elections but Udall's intensive work frequently was mentioned during the Kennedy campaign when the president-elect included him among the "young leadership" needed to sail the ship of state.

Foundations for Haynes

Foundations have been completed for two generating units at the Los Angeles Department of Water & Power's Haynes steam plant, under construction near Seal Beach. Raw water and oil storage facilities have also been completed.

Washington Report

Discuss Upper Snake Projects

Three public hearings—sponsored by the Corps of Engineers and the Bureau of Reclamation—were held in Idaho in early December to discuss water development projects in the upper Snake River basin.

The two federal agencies are preparing a final report, following the hearings, to include all possible projects for the basin, whether they are presently considered economically feasible or not. This report won't be made available until sometime in 1961, but a tentative report by the two agencies shows a possible 80 projects in the area—from the Snake River headwaters downstream to the Powder River, Ore.—including flood control, irrigation, power and navigation dams, plus local channel and levee works. The two federal agencies point out, "Some of the development possibilities are not presently feasible or acceptable, and their development, or an alternate, may not come for many years . . ." The 80 projects include 46 reservoirs with potential storage of 7,041,000 acre-ft and a potential power capacity of 1,241,500 kw.

Many of the projects have been under discussion for years, while others are brand new in concept. One of the projects is Burns Creek Dam, on the Snake River, Idaho: 90,000 kw, about $45 million to build. Others are Garden Valley and Scriver Creek projects, Payette River, Idaho (368,500 kw, $159,890,000); Snake-Narrows project, Wyo. (270,000 kw, $101,840,000); Long Tom and Hillcrest projects, Idaho (140,000 kw, $172,635,000); Thousand Springs Reservoir, Snake River, Idaho (150,000 kw, $60,884,000).

The final report—first joint effort by the two agencies—should be more detailed for the Upper Snake than the latest report on the Columbia River by the Corps of Engineers.

Hearings To Reconvene

The next big phase of the FPC hearings on the rival Nez Perce and High Mountain Sheep Dam projects is expected to turn on what effect the proposed joint development of the Columbia River (by the U. S. and Canada) will have on the projects. Bonneville Power Administration's commercial operations officer, Bernard Goldhammer, will testify shortly after Jan. 9 to explain a Bonneville estimate that the proposed added prime power afforded by the joint Columbia development precludes the need for immediate development of either Nez Perce or High Mountain Sheep.

Water Pollution Studied

A national conference on water pollution, sponsored by President Eisenhower, was held in mid-December in Washington, D. C., to study various problems involved in stream pollution, including "thermal pollution": heating of stream waters beyond the point where normal fish life and oxygenation can take place.

The conference, however, was set against a political background which may render them meaningless—Rep. John Blatnik (D-Minn.) plans to introduce a bill in early January for a federal pollution program, and he thinks hearings were unnecessary.

Blatnik's proposed bill will call for a boost from $50 million to $100 million in federal construction grants for municipal sewage plants, a $3 to $5 million boost for interstate pollution programs, an increase in federal pollution enforcement powers, creation of about six regional federal pollution laboratories, and possible removal of the pollution program from the Public Health Service to an independent status within the Department of Health, Education & Welfare.

Edison Electric Institute was represented by Vice President L. W. Cadwallader of Potomac Electric, who also is a member of the conference's steering committee.

The problem of thermal pollution, as far as steam generating plants are concerned, hasn't been adequately studied to make any final determinations. The Public Health Service points out that warm water reduces the natural cleansing action of streams, and it also drives away game and "better" fish.

Communications

► **Effective date** for interim microwave technical standards has been postponed from Jan. 1 to July 20, 1961, as a result of a petition filed by the Electronic Industries Assn. (EIA) last August. In granting the extension the commission stated that "it now seems clear that such additional time may be necessary in order to permit manufacturers to make the necessary plans and effect appropriate redesign and production of equipment capable of meeting the new standards." However, the commission saw no merit in the proposal to grant a five-year extension of time in which existing systems would be allowed to expand with equipment meeting the present frequency stability and bandwidth requirements. In denying the request the commission cited the fact that it would be inevitable that there would be an intermingling of stations designed to operate under different standards, and that the situation would only be worsened by allowing more stations to be installed under the old standards. Equipment authorized prior to the July 1961 date will be allowed to operate until harmful interference is caused to another user who is operating under the new standards. Take heed if you are planning an extension next year that will require matching equipment now in service. If the authorization is obtained later than the above date it will specify the new standards—and this will be embarrassing unless planned for.

► **PG and E's 1,000-mile microwave extension** is on its way, using the latest in path survey methods and solid state equipment. Bob Brinton of the company reports that the paths connecting some 25 stations were surveyed, using radar techniques and helicopters to reach inaccessible locations. The RF equipment will be supplied by Motorola for operation in the 6,500-mc range and will be a radical departure from present tube types. The multimillion-dollar project, which will follow a pipe line, starts at the Idaho-Canadian border and traverses a course through Washington, Oregon and into California where it is integrated into the present PG and E system starting at Burney and terminating in the San Francisco area.

► Spurred on, no doubt, by the FCC order requiring licensees in the Business Radio Service to use **microwave frequencies above 10,000 mc,**

several manufacturers are already offering equipment. Because of the large potential market it is likely that development will be much more rapid than it was with the 6,500-mc gear, and prices should be only moderately higher. Little or no use has been made of microwave in this band by Power Radio Service users because of the lack of equipment. The FCC has indicated that intracity microwave systems must use the higher frequency bands in the future; however, this would not apply to extensions of systems into a city terminal. Propagation is adversely affected by heavy rain, but with the possible exception of some coastal areas, the West should be an ideal area for the use of this high-frequency equipment.

► **450-470-mc split channels** are being proposed by the FCC in a new Docket No. 13847, which was published in the Federal Register of Nov. 18, 1960. This will be a hot one, with reams of comments being filed by nearly all classes of users before the comment deadline of Feb. 3, 1961. The commission proposes to reduce the frequency spacing from 50 kc to 25 kc, reduce the deviation from 15 kc to 5 kc, and make the allowable bandwidth 20 kc. Equipment in operation prior to Nov. 1, 1958, will be allowed to operate "not later than Nov. 1, 1963," with the old technical standards, but equipment installed after the '58 date will be required to conform with the new standards six months after finalization of the order. In addition, the commission would prohibit the use of these frequencies for fixed stations other than secondary control of a mobile relay station, and would derive frequencies from the "secondary" channels for two new services to be known as the aviation terminal service and the industrial protection service. Except as affected by the above conditions, the electric utility users will gain by the proposal to the extent of 10 new frequency assignments, which will be paired 5 mc apart to permit duplex operation. And you can be sure that the common carriers will be there with a pitch for some of the frequencies.

► **Chelan PUD was confronted by an irate logger** shortly after the bid opening for the data logging system that was described in last month's column. The man caused some consternation and, it must be admitted, hilarity until it was explained to him that this logging operation had nothing to do with timber.

Nuclear News

Contract for Allis-Chalmers

The Allis-Chalmers proposal for a 50,000-ekw nuclear power plant has been selected by the AEC as the basis for contractual negotiations. The plant will incorporate a boiling water reactor of improved engineering design and will be the prototype for a 300,000-kw reactor incorporating features aimed at reducing power costs.

Under the proposed arrangements for the project, two municipally owned utilities (Los Angeles and Pasadena) will provide the plant site in Haskell Canyon, Los Angeles County, Calif., and the turbogenerator facilities. They will operate the facility for the AEC for not less than five years and purchase the steam produced by the reactor.

Under terms of the proposal, Allis-Chalmers will design, fabricate, construct and test operate the reactor, furnish the first core and spare fuel elements, and provide training for operating personnel. The nuclear plant is planned for completion in early 1964.

Achieves Criticality

The plutonium recycle test reactor at the AEC's Hanford Works achieved initial criticality on Nov. 21. This reactor, a pressure-tube type, is cooled and moderated by heavy water and has a maximum power of 70,000 thermal kw. The plant will be used to test plutonium-bearing fuel elements and develop technology and techniques for using recycled plutonium as fuel in civilian power reactors.

This reactor, operated for the AEC by the General Electric Co., is expected to be an important research tool in developing a system whereby plutonium produced from uranium-238 in one fuel cycle of a power reactor would be used to enrich fuel in a later cycle.

Superheat Developmental Reactor

General Electric in conjunction with seven New York State investor-owned utilities will build an $8 million superheat developmental reactor at Pleasanton, Calif., to help extend technology of nuclear superheat for eventual application to large-scale nuclear power plants.

The new 15,000 thermal kw reactor, which will be built alongside the Vallecitos Boiling Water Reactor (VBWR), will be used to raise the temperature of steam produced in the VBWR to levels achieved in conventional steam-generating stations using modern, highly efficient turbine-generator facilities.

Completion Date Extended

The AEC has issued an order extending to July 15, 1961, the latest completion date for the Power Reactor Development Co.'s reactor project at Lagoona Beach, Mich. This order is subject to any final judgment or order entered by a court in the pending judicial proceeding in the U. S. Court of Appeals and the U. S. Supreme Court.

The company had asked the commission to extend the completion date from Dec. 15, 1960, to Dec. 15, 1961, because of fuel development problems and other factors beyond its control.

Uranium Purchases

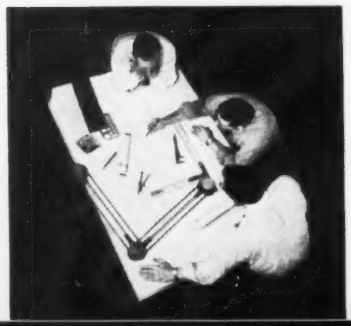
Uranium concentrate purchases under 27 domestic milling contracts have been announced by AEC. Beginning with July 1, 1960, the government has contracted for 191 million lb of uranium concentrate valued at $1½ billion. These figures include the result of the extension of 15 of the 27 contracts through Dec. 31, 1966. Review of the remaining 12 contracts is now under way, which will increase the contracted amounts of concentrate.

Dresden Control Rod Trouble

Dresden Nuclear power station was taken off the line and shut down on Nov. 15 when one of the 80 control rods in the reactor became separated from its drive mechanism. Preliminary investigation of the faulty rod disclosed that the drive tube, to which the control rod is attached, had severed due to stress corrosion cracking of the stainless steel used in the tube.

A second drive tube was inspected and also showed some evidence of cracking. Commonwealth Edison Co., owner of the plant, said that a full check will be made of all the reactor's control rod mechanisms. It is planned that all of the nuclear fuel in the reactor will be removed and placed in storage to facilitate removal of the drive mechanisms.

CONCENTRATION



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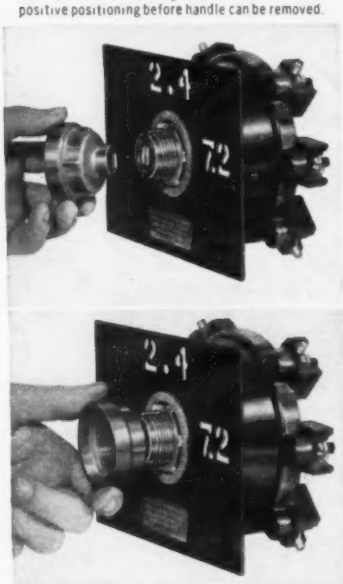


TT

People

Bechtel

S. D. Bechtel Jr. Named President of Firm

Stephen D. Bechtel Jr. has been elected president of Bechtel Corp., international engineers and constructors with headquarters in San Francisco. The announcement was made by S. D. Bechtel, who will continue as chairman of the board of directors.

The election marks the advent of third-generation leadership into the business founded by W. A. Bechtel. Two presidents—W. A. Bechtel and S. D. Bechtel—held this office during more than six decades of the firm's activity.

► **Ernest E. Johnson,** a member of the Washington Water Power organization since 1922, has retired. He will be succeeded as division plant superintendent by **Roscoe C. Smolisky,** assistant to the division plant superintendent at Lewiston. **George T. Pettichord** succeeds Smolisky.

► **Walter R. Neumann,** superintendent of the Frank Bird steam-electric generating plant at Billings, Mont., since its completion in 1951, has been transferred to Butte as assistant to superintendent of power and generation for Montana Power Co. According to President J. E. Corette, Neumann will be trained to assist in the company's participation in the Northwest Power Pool and help coordinate the production at Montana Power's 14 plants. He will assist Robert R. Rend, superintendent of power, and William D. Eminger, superintendent of generation.

► **Grover Anderson,** after some 40 years with the Harvey Hubbell Co. as manager of its San Francisco office, retired Jan. 1 but will remain in a consulting capacity. **Wayne Brassey,** who was with Anderson for 10 years but who has spent the past three years at the factory, returns to San Francisco as manager.

Tenney

George Tenney Comes Home

George Tenney is coming back West. But he had to retire to do so and he has—earlier than customary. Born in Provo, Utah, raised in San Jose, Calif., schooled at University of California and editor of ELECTRICAL WEST most of his working life, he loved the West and it was only five years ago that he was persuaded to accept a top management job with McGraw-Hill in New York.

Although several times he was borrowed to help out topside, it was only that long ago that he went to New York to devote more time to his responsibilities as a vice president of the parent company. Even so he commuted back West to maintain supervision of the California company as its president. His residence officially always remained here.

His job done in New York, he has returned, bought a home in Sausalito, remodeled it to suit his new bride and himself and he intends to commute only across the Bay to Berkeley to the University of California. He means to finish college that World War I interrupted, take some additional subjects and perhaps teach some business journalism courses himself.

Summertimes he and his wife will spend at her Cape Cod home. They intend to travel to Europe and over the world. It is inconceivable that he will cease to be an influence in ELECTRICAL WEST's future and in the growth of the California company. But he will be free to do the fly fishing he loves and the duck hunting he enjoys in bay moors.

For the staff of ELECTRICAL WEST and members of the California offices, it is good to have him home again. The electrical industry of the West, in which he has been such a force, must feel the same way about it.

Nelson

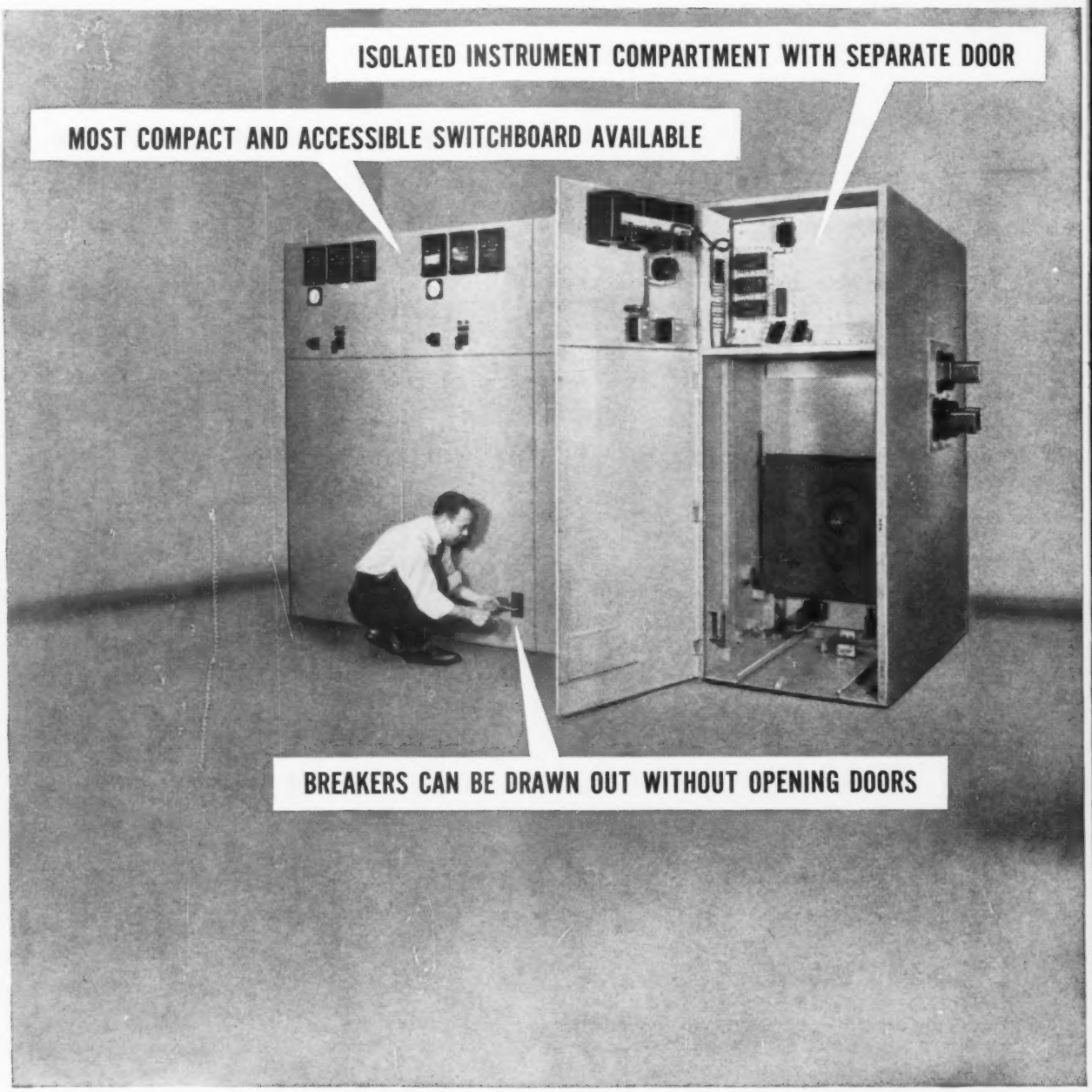
Nelson Succeeds Peterson At Los Angeles

Samuel B. Nelson has been appointed general manager and chief engineer of the Los Angeles Department of Water & Power, succeeding William S. Peterson who retired Dec. 31.

Peterson had served with the department as engineer and executive for 38 years, and had been general manager for the past five years.

Nelson has been with the department for 34 years and since 1955 has been chief engineer for the Water Works. He has been active in civil defense work.

► **O. R. Doerr,** vice president in charge of sales for Pacific Gas and Electric Co., has been elected president of the San Francisco Chamber of Commerce for 1961.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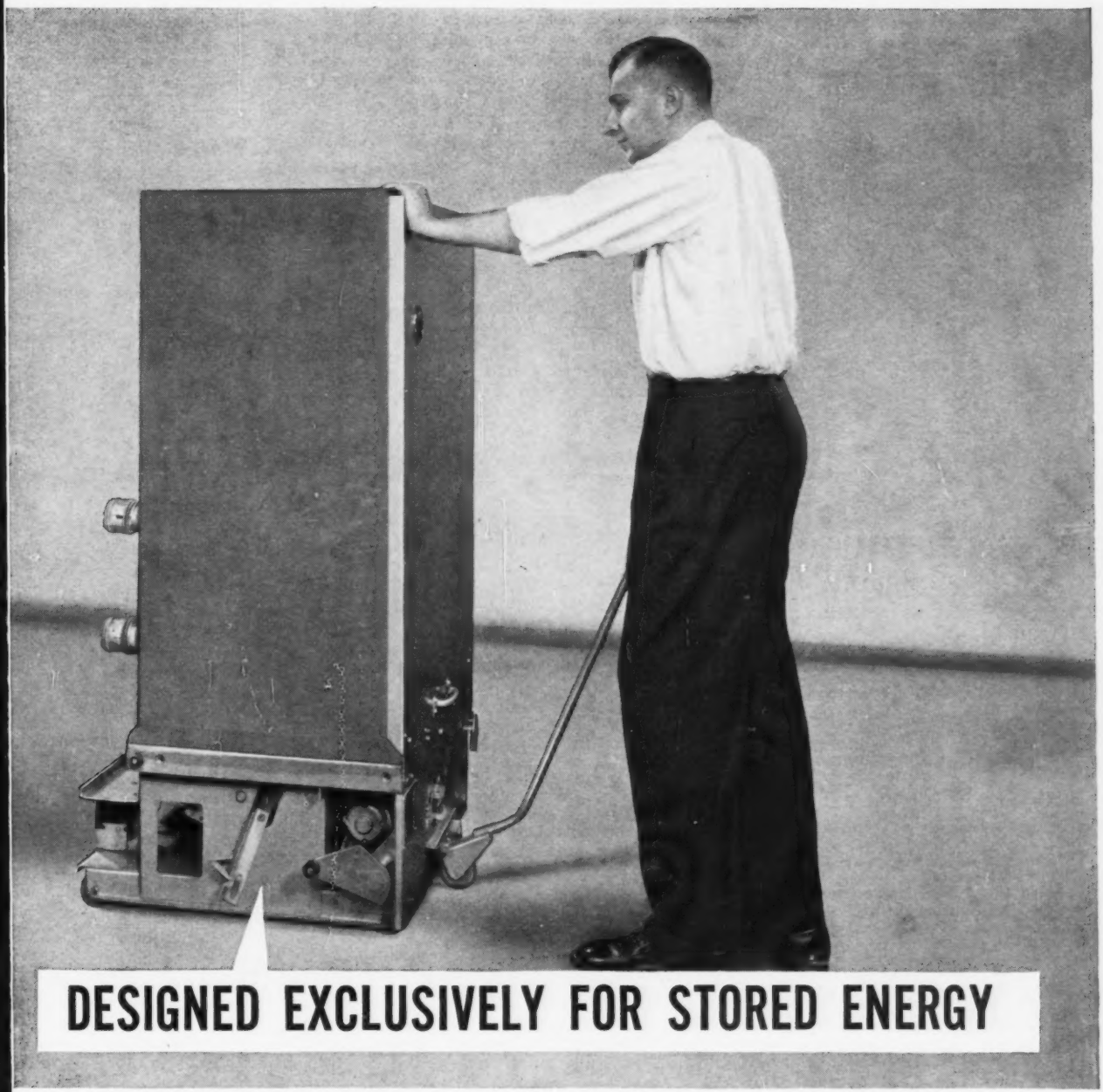

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► **Francis E. Ash,** Tacoma businessman and registered professional engineer, has been appointed to the newly created position of head of the administrative division in the Tacoma Department of Public Utilities. The post, created four years ago on recommendation by McKinsey & Co.'s organizational survey, had not previously been filled. Ash most recently has been part owner and vice president of the Tide and Bay companies, handling electrical and mechanical contracts in the Pacific Northwest, Alaska and Hawaii. In the utilities department, he will supervise operations of the purchasing, automotive, property management, personnel, safety and general services section.

► **Kenneth A. Kraft** has been named advertising supervisor of Puget Sound Power & Light Co. He has served as staff assistant in the company's public relations department during the past four years. Before that, he was an Information Services officer with the United States Air Force. In his new position, Kraft will be located at Puget's general offices in Bellevue. In addition to his advertising duties, he will continue to edit the company's publications.

Kraft

► **Two British Columbia engineers** were honored at a testimonial dinner in Vancouver by the Vancouver, B. C., Section, American Institute of Engineers, which has elected them as Fellows. They were **Henry Smith,** at one time assistant chief engineer, B. C. Electric, and subsequently general manager, B. C. Engineering Co., and **Francis Wollaston,** consultant to International Power & Engineering Consultants, and directly responsible for design and development of B. C. Electric's extra-high voltage lines.

► **Paul V. Winkler** has joined the Matzinger-Johnson Co., representing electrical manufacturers. He was formerly with the H. K. Porter Co. Inc., Delta-Star Electric Division.

► **Ann Vennart** has joined the staff of Capital Wholesale Electric Co., Sacramento, owned by her brother, E. J. Duffy. She is a graduate of the Academy of Lighting Arts course and will be lighting consultant.

Boaz

Thompson

► Personnel changes in San Diego Gas & Electric Co.'s Commercial Division were announced by R. J. Phillips, vice president-sales, following the retirement of E. W. Meise. **J. K. Boaz** has been named sales manager, succeeding Meise, and **C. M. Thompson** has been assigned to the newly created post of residential sales director with responsibility for both electric and gas sales activities. **A. J. McCutcheon Jr.** was appointed supervisor of lighting and wiring sales, both residential and commercial. **G. S. Kimball** was made governmental sales supervisor.

► San Diego Gas & Electric Co. has appointed **Daniel L. Turner** as manager of the La Jolla District, succeeding the late Lemoyne Lambert. Turner has been with the company for 29 years and before his new appointment was visual education director.

► **Outstanding Boss** is the title awarded **Charles Earnshaw** by the Alameda Junior Chamber of Commerce. He is chief of the central district engineering department for Pacific Gas and Electric Co. At 33 he is one of the youngest men to hold such a post with the company.

► **Donald H. Westrick** has been appointed project engineer at the U. S. Army Corps of Engineers' Detroit Dam, succeeding **Walter A. Mackie.** Mackie has gone to Bonneville Dam as project engineer, replacing **Albert M. Capps,** who retired after nearly 25 years' service. Westrick has served on the technical staff at Bonneville for the past seven years.

Westrick

► **Howard W. Price,** former president of the Intermountain Electrical Assn., Salt Lake City, and executive vice president of Salt Lake Hardware Co., has been named for a second term as president of the National Wholesale Hardware Assn.

Pond

Powers

► **Gardner P. Pond,** vice president of J. H. Baxter & Co., has announced that he will relinquish responsibility for southern California operations following 38 years in that position. Taking over these duties will be **Gleeson A. Powers,** now assistant district manager. Pond will retain his present post as a vice president of the wood preserving concern but will serve on a consulting basis.

► **Fred A. Allehoff** has been given new duties as sales engineer for S&C Electric Co. in the western half of the State of Washington. He will continue to cover Oregon, northern Idaho and western Montana and eastern Washington. His headquarters are in the Weatherly Building, 516 E. Morrison St., Portland, according to **John R. Conrad,** company president.

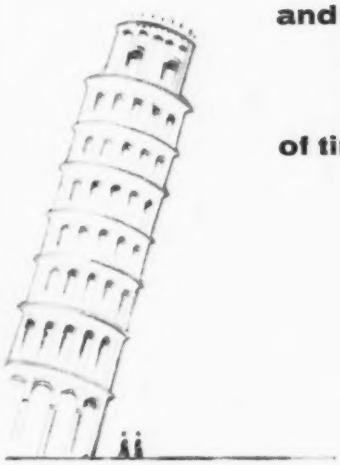
Allehoff

► **Howard H. Weile** has been named PG and E's Coast Valleys Division manager, succeeding the late T. Emmet Ward. A native of Spokane, Weile has been with PG and E and its predecessors since 1923. His headquarters will be at Salinas, where he has been serving as general services manager for the division.

► **Orren Brownson,** assistant vice president of Pacific Light & Power Co., has been elected to a three-year term on the board of directors of the Portland Chamber of Commerce.

► **Charles W. "Chic" Macy** will retire from Pacific Gas and Electric Co. Feb. 1 to become a lighting consultant in the San Francisco area. He has been with the company 32 years and has headed the lighting advisory group in the San Francisco Division for many years. He was responsible for several important lighting developments and fixture designs.

put up an improperly designed photocontrol, and it's also just a question of time.



Apparently no one got a good look at the specs for the Pisa tower — or maybe the mayor was the architect's uncle. Who looks at the specs of the streetlight controls *you* buy and put up in the thousands — and what proof does the vendor offer to back them up? Time will supply the answers, if your source doesn't. The Fisher-Pierce Co., 43 Pearl St., So. Braintree 85, Massachusetts.

FP

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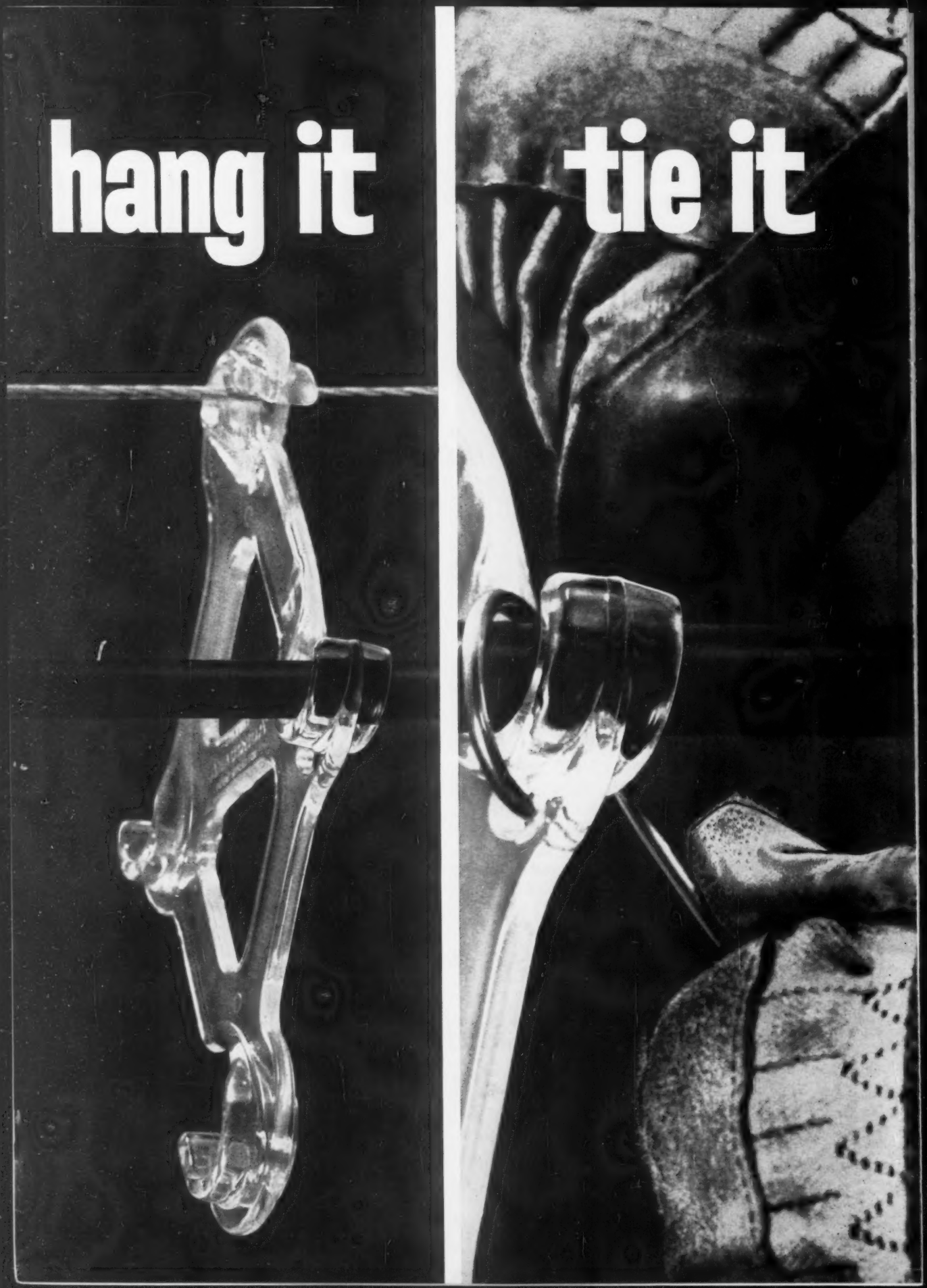
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Wesley Hicks

The electrical industry lost one of its pioneers with the death of W. Wesley Hicks on Dec. 8. He was 76. Wes Hicks spent all of his adult years serving the cause of electric living. After attending Stanford University he was a wireman, contractor, electrical engineer with the Signal Corps, sales engineer for the Great Western Power Co., and founder-president of the Wesix Electric Heater Co.

In 1919, he clearly saw the convenience, comfort, flexibility and safety that many in the industry see in electric space heating today. He founded the predecessor of the Wesix Electric Heater Co. in that year. Armed only with engineering knowledge, vision and the conviction that consistent quality would make the customer his best salesman, he built a major manufacturing organization with national distribution.

In 1948 he saw in air ionization the "missing link" in comfort conditioning. Some work in this new field had been done in Europe but none in this country. He made generous contributions to the Wesix Foundation to push university and medical school research and through Wesix Engineers he developed equipment so that today ion-controlled air is available for nuclear submarines, space vehicles and the average American home.

► **Frederic J. Sutherland,** retired some years ago from Pacific Gas and Electric Co., San Francisco, who has been the official librarian for the San Francisco Press & Union League Club, died late in October.

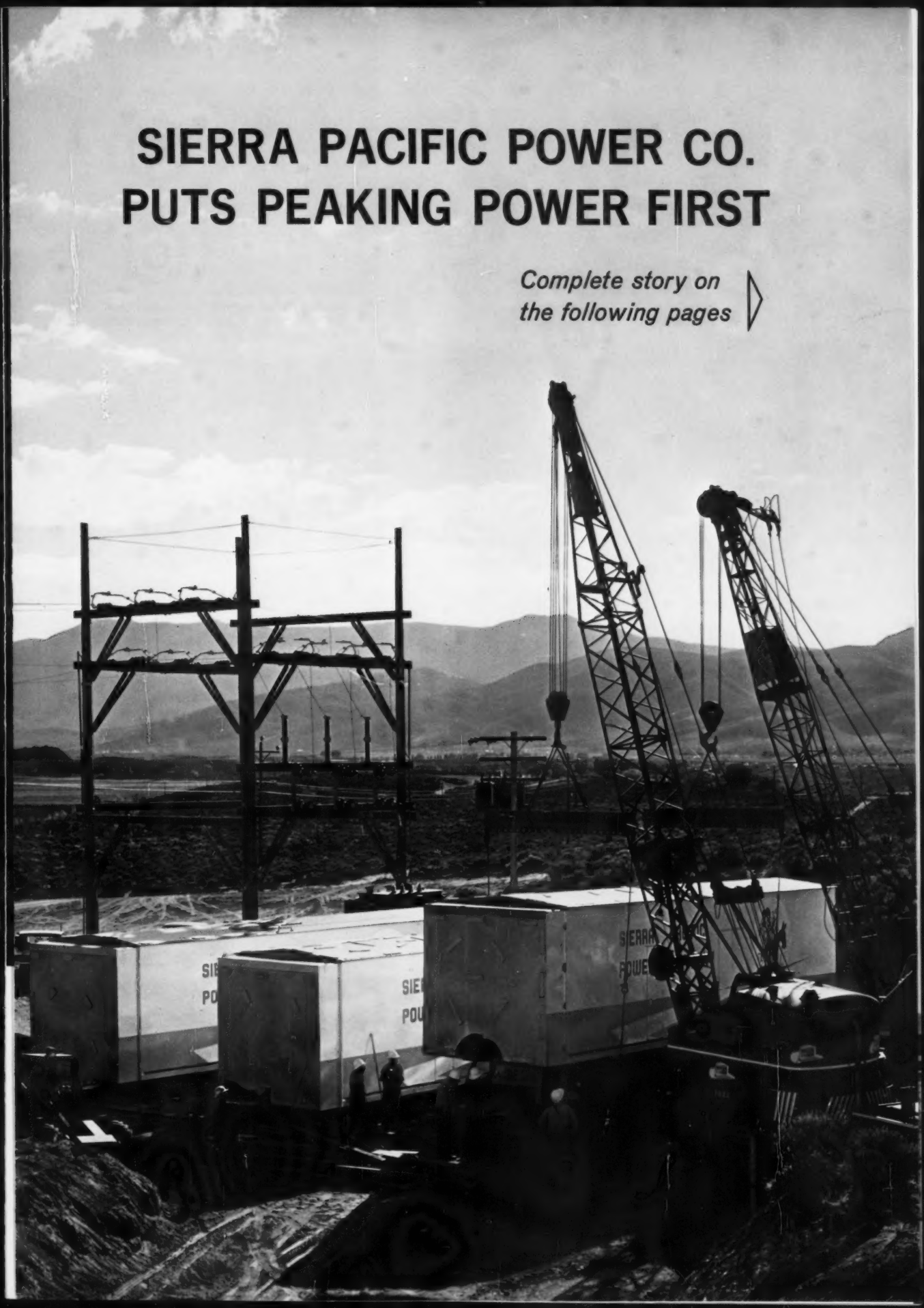
► **Harry B. Batchelder,** 60, Central Division sales manager for Puget Sound Power & Light Co. since 1954, died Nov. 17 following a heart attack. He had worked for the company since 1923 at Leavenworth, Wenatchee, Seattle and Renton.

► **Harry Barnard,** one of the Western pioneers among manufacturers' representatives in San Francisco and Los Angeles, died Nov. 17, age 82. He was associated with the F. J. Airey Co. in Los Angeles from 1935 to 1955, at which time he retired. He had previously been with Curtiss Lighting, Newbery Electric and other firms.

► **T. Emmet Ward,** PG and E's division manager at Salinas since 1945, died in November following a long illness.

SIERRA PACIFIC POWER CO. PUTS PEAKING POWER FIRST

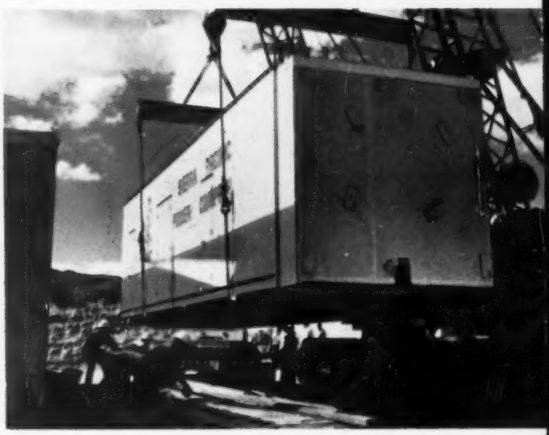
Complete story on the following pages



1. Five low-boy trailers begin 35 mile trip from rail yards at Reno to the Brunswick Substation at Carson City.

3. Crews begin installing transformer, fuel tank and associated equipment, while railroad tie beds are laid for peaking plant.

2. Electro-Motive units, plus 6000 KVA step-up transformer and fuel tank, begin arriving at site evening of October 3.



4. Last of four Peaking Plant units is lowered into place from its trailer by large cranes.

5. The Electro-Motive plant is ready for final electrical connection and piping at the end of second day.

AT CARSON CITY... peaking plant in place in 19½ hours

The third Sierra Pacific Peaking Plant, installed at Carson City, demonstrates the high mobility and flexibility of the Electro-Motive equipment. Starting at 8:00 A.M. on October 3, the Electro-Motive MU-60 scheduled for Carson City was loaded from rail cars onto low-boy trailers for the 35 mile trip to Carson City. Loading was completed at 3:00 P.M. and the caravan arrived at the plant site at 7:30 P.M. Beginning at 8:00 A.M. on October 4, the three 2000 KW generating units, control unit, 6000 KVA transformer and 20,000 gallon fuel tank were unloaded and placed in position by 5:00 P.M. Photos detail moving and installation over 19½ hours.

To meet winter peak demands . . .

SIERRA PACIFIC POWER CO. ADDS THREE 6000 KW PEAKING PLANTS

The Sierra Pacific Power Company is meeting anticipated 1960-61 Winter peak demands with 18,000 KW generated by two new 6,000 KW Electro-Motive Peaking Plants installed at Reno, and a third plant installed near Carson City, Nevada.

PEAKING POWER COMES FIRST

Base load power supply on the Sierra Pacific system is purchased from Pacific Gas and Electric Company and is transmitted across the Sierra-Nevada range from Summit substation 40 miles west of Reno. In addition, Sierra Pacific Power Company supplements this base load with four small hydro plants with about 9,000 KW capacity. With the addition of the three Electro-Motive Peaking Plants, Sierra Pacific is putting peaking power first, in their six year plan of system expansion, to meet load growth and peak demands.

Sierra Pacific expects winter peaks on the system ranging up to 136,000 KW during the months of November through February. Peaks will occur between 5:00 and 7:00 p.m., and will require Peaking Plant operation of one to four and a half hours daily.

REMOTE CONTROL OPERATION

The Electro-Motive Peaking Plants are remotely controlled from the system dispatch center at Reno. The dispatch center is located 35 miles from the Carson City installation and three miles from the Reno Peaking Plants. Remote supervisory control allows the Peaking Plants to start up, synchronize, go on the line and operate unattended. Output of the units is fed directly into a bus through a transformer connected to the system base supply.

ECONOMICAL PEAKING POWER

The total installed cost of the three Sierra Pacific Peaking Plants (including site preparation and all auxiliary equipment) was below estimate, and considerably below the cost of base load generating equipment designed to do the same job. Decentralized Electro-Motive Peaking Plants were the lowest cost solution to Sierra Pacific's immediate problem.

Electro-Motive Peaking Plants themselves, together with control equipment, connecting cables, lube oil and supplies, averaged $88 per KW, delivered at Reno. Locating units at or near load centers provides saving in losses at peak load. Each generator is rated 2000 KW/2500 KVA, .8 power factor. This provides vars for voltage regulation benefits at the time of peak.

For a detailed photo story of the Carson City installation, see the opposite page.

AT RENO . . . two MU-60 peaking plants back-to-back

Two Electro-Motive MU-60, 6000 KW, Peaking Plants are installed back-to-back at Reno—first such installation in the country. This installation illustrates the building-block capabilities of the basic Electro-Motive Plant design.

Such Peaking Plants can be installed with any KW capacity from 2000 KW up, in increments of 2000 KW. Provision for expansion is built in, too, making it possible to increase any given capacity from 2,000 KW to 10,000 KW utilizing same control units.

ELECTRO-MOTIVE DIVISION · GENERAL MOTORS

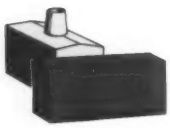
LA GRANGE, ILLINOIS • **Offices:** Chicago, New York, St. Louis, San Francisco

In Canada: General Motors Diesel Limited, London, Ontario

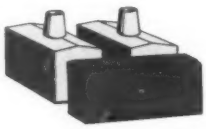
Electro-Motive peaking plants now available in capacities up to 10,000 KW

The Electro-Motive peaking equipment line contains both Diesel and dual-fuel plants in a range of sizes, which permit matching the plant to exact requirements for the most economical and efficient operation at the lowest investment. When load growth occurs, additional generating units may be added at low incremental cost to bring the plant up to desired size.

The reliability of Electro-Motive peaking units results from many years of operating experience with the 25,000 GM-567 Diesel engines now in service. This engine is the heart of the peaking plant. Control equipment for the peaking unit has evolved over a period of six years through more than 100 prototype plants. And behind this proven, reliable plant, Electro-Motive stands as a single-source manufacturer with single-source responsibility for your peaking power requirements. Ask your Electro-Motive representative for complete details. With prompt action, Electro-Motive Plants can be handling your next peak load.

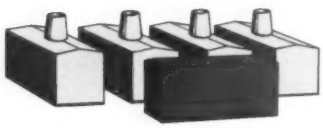


MU-20 2000 KW Diesel
MU-14DF 1000 KW Dual-fuel

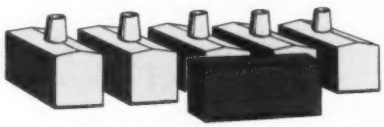


MU-40 4000 KW Diesel
MU-28DF 2000 KW Dual-fuel

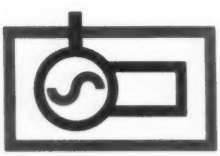
MU-60 6000 KW Diesel
MU-42DF 3000 KW Dual-fuel



MU-80 8000 KW Diesel
MU-56DF 4000 KW Dual-fuel



MU-100 10,000 KW Diesel
MU-70DF 5000 KW Dual-fuel



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GENERAL MOTORS La Grange, Illinois
Offices: Chicago, New York, St. Louis, San Francisco
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Market Development

1.

2.

3.

New Models at San Diego Show

The usual capacity crowds thronged to San Diego's Balboa Park following Thanksgiving to see the new products and get ideas for Christmas giving. Attention getters this year were appliances, both big and small, hi-fi and TV, wood working tools. Another feature was the first public showing of the Norge automatic cleaning equipment for coin-operated laundries. Many show visitors took advantage of the offer to have a garment cleaned free during the show.

1: Gene Carter, Vernon Lee Cook, president of Commercial Laundry and Dry Cleaning Equipment of Los Angeles, and Home Economist Kathleen Brick get ready to deliver cleaned clothes

2: Magic show, promoting electric blankets, drew big crowds

3: California Appliance takes around a model kitchen in a truck to show off its built-ins. H. Ashmun of that firm and Richard Brandow of Texboro Cabinet Corp. manned the exhibit at the show

20 Words Won This Light for Living Gold Medallion Home on Mercer Island

Mrs. Robert D. Milloy of Seattle, who was planning to build a new home on Mercer Island, decided to try for a prize in the Edison Electric Institute's "1959 Why I'd Like to Live in a Light for Living Home Contest." Result: One of four prizes—a $20,000 home. Although the plans were furnished, Mrs. Milloy got approval from Puget Sound Power & Light Co. (who handled arrangements for EEI) to make some modifications. She won cooperation of builders, suppliers, contractors and others in securing a house valued at roughly twice the original prize. Shown left are Mrs. Milloy, with Ken Hollingsworth of Puget Power. Center is a section of the living room; right, the dining area. The home was given a public showing last fall.

ELECTRICAL WEST

SPOKESMAN FOR THE MOST HIGHLY ELECTRIFIED REGION OF THE U. S.

Vol. 126, No. 1 January 1961

The industry has that rosy-cheeked appearance of glowing health and immortality

We selected Mr. Levitt to "see us" after reading his article "Marketing Myopia" in the *Harvard Business Review*. Why not, we wrote, "enjoy the visceral feel of editorial greatness" by analyzing the electric utility industry from the marketing viewpoint. Charmed indeed—for a price—wrote Mr. Levitt.

The following article is the most intuitive, the most objective and penetrating look at our industry that we have seen in many a moon. If you have an open mind, a sense of humor and a delight in potent ideas powerfully put, dig in. This warning first. We sense that between belly laughs you will find Mr. L's brogans on some exposed nerves. Helping Mr. Levitt wield the needle and scalpel is Walt Miller, our cartoonist.

January seemed the right time to do it. January, because it is the season of the year for resolution and contrition. This year's January for the special reason that our new President will take office. If Mr. Kennedy tries to fulfill his campaign promises, the subject of "How to be an eclectic utility" may be timely indeed. In no other industry are the customers also the stockholders, the public and the electorate. We will learn to serve our customers the "cluster of values" they want, as they want them, or we will perish.

Also in the soul-searching vein, we recommend the industry's attention to our survey "Prices, Products and Progress." Twenty manufacturers have leveled with us on what they have had to do to live with today's prices. Question: Will tomorrow's users be able to muster the equanimity it may require to live with today's products?

Then our semiannual appraisal of the Western economic outlook—as compared with the U. S. as a whole. If he didn't have the facts nailed down, we would suspect McGraw-Hill Economist Bill Brown of bucking for a transfer. The moral, kind reader: You're in clover—relatively, at least.

Please read This is America, p 1. It is the first of a series on the elemental truths of American free enterprise. The series will be simple, down to earth, non political. We make no pretense of objectivity! We believe in government that governs—not provides. We feel that freedom guarantees a right to succeed—or to fail. We think nations, like people, must live within their means. We contend that willing hard work is the essence of national survival. Charity is a personal, not a political, virtue. We are biased this way, and proud of it.

If you feel strongly as we do, ask your company's house organ editor, ask your newspaper editor, to reprint it. Send it to your friends.

For those who care to reproduce all or part of this series we will mail on request quality proofs for direct photo copying. No charge, it's our privilege. After all, This is America.

The marketing approach to business survival or

YOU MUST BECOME AN ECLECTIC UTILITY

THEODORE LEVITT, HARVARD GRADUATE SCHOOL OF BUSINESS ADMINISTRATION

The first business of every business is to stay in business. To do that you can't just rely on your production competence, raising your efficiency, cutting your distribution costs, speeding up your handling of new installation or maintenance calls, or on the fact that you're involved in a lot of prestigeful community service activities and that you're getting a nice press.

Staying in business is a problem for every business, even businesses which by all outward appearances seem invincible.

The electric utility industry has that invincible look, that rosy-cheeked appearance of glowing health and immortality. Yet there is every reason to believe that this is a self-deluding mask. Behind it there are all kinds of suicidal industry practices and attitudes. One day they'll come home to roost, not with some thunderous bang that sounds the industry's cataclysmic death knell, but with a slow and purposeful accretion.

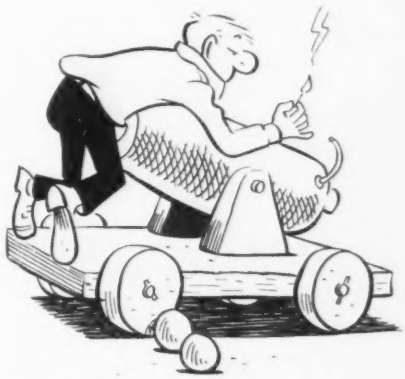
One reason that I say that the electric utility industry may be headed for trouble is because it calls itself the electric utility industry. If that is what it believes its business to be, there is a good likelihood that it may not stay in business. **If it defines itself as the electric utility industry, it will automatically confine itself to thinking in terms that keep it from prospering and living.**

Wall Street gives its seal of approval so ardently that even European royalty invests in American electric utilities

All this sounds pretty ominous, I know. The weight of a lot of solid evidence would seem to be against such a gloomy outlook. After all, electricity is not one of those exotic new Buck Rogers ideas. It has a long, solid and successful history. The world is committed to its enormously expanding use in numerous ways. The electric utility companies are run by the nation's most seasoned and respected executives. All together, the companies are probably in better financial condition than those of any other industry. And to top it off, Wall Street gives its official seal of approval so ardently that even European royalty invests in American electric utilities.

This is a very reassuring picture—for the present. But what about the future? Some indication of how fast the tide can turn is provided by the inglorious history of American railroads. Fifty years ago they were acclaimed more lyrically than electric utilities are today. Not only were they considered a sound and solid industry, but also a growth industry of almost unlimited possibilities. I ask the reader to pause momentarily to reread the preceding paragraph and substitute the word "railroad" wherever the words electricity or electric utility appear. This gives you a modest idea of what was so enthusiastically said about American railroads only 50 years ago.

The railroad was hailed as a sort of industrial messiah, the culmination of civilization, the zenith of technological efficiency, the immortal mark of our final conquest of time and space. It was not only hailed as a prodigious growth industry of Brobdingnagian possibilities but, more important, as a symbol that marks the epochs of man. It was considered the most advanced physical and social organization of the entire 19th century—"an institution, an image of man, a tradition, a code of honor, a source of poetry, a nursery of boyhood desire, the sublimest of toys." To have suggested to anyone then that in 30 years most railroad companies would be in receivership and in shabby disgrace, and that in 40 years most of them would be out of or trying desperately to get out of passenger service operations—to have suggested this 50 years ago would have marked a man as utterly insane. It was not even a question worth entertaining, let alone answering or, for that matter, asking. But today with our 20-20 hindsight, the inglorious decline of this once-glorious industry doesn't seem so improbable. **Is it possible that in 50 years we might see a similar retrospective picture of a once-glorious electric utility industry?** Or is this as ridiculous a possibility today as it seemed for the invincible railroads 50 years ago?



Customer orientation is needed to avoid astigmatic policies that lead to suicide

The railroad industry is an obvious kissing cousin of the electric utility industry. It, like electric utilities now, seemed to be what economists call a natural monopoly. Like the electric utilities, nothing effectively competed with the railroads for simplicity, speed, flexibility or economy. Their superior merits were so pervasive that, for most purposes, competition was helpless. Because of this fact, because of the absence of adequate competition, railroad prices and operations were closely regulated by government authorities.

The Decline and Fall

A look at why the railroads descended so rapidly and so low is instructive for the electric utility executives who now live with the comforting and even tranquilizing thought that their companies are on some automatic escalator that magically doubles their business every 8 or 12 years.

I believe the major reason the railroads descended into fiscal purgatory is that they defined themselves as being in the railroad business instead of the transportation business. They were product oriented rather than customer oriented. Hence they constantly looked toward making and running better trains, not toward providing their customers with better transportation. Being product oriented boxed them in. Had they been customer oriented they would have tried vigorously to provide whatever cluster

The first rule of survival: Define your industry in the broadest possible terms

of values their customers preferred, regardless of the consequences for their enormous investment in railroads. In other words, they would have gotten into the trucking business, into the bus business, into the pipe-line business, into the airlines business and into the commercial communication business. It does no good to provide the world's best rail transportation when people prefer airplanes. It does no good to declare pridefully today that the railroads are even now the lowest cost producer of mass transportation, either for people or for goods, when it is something other than rock-bottom per-mile prices that people want. It's what the customer, not the seller, wants that counts.

The point is, a business must be thoroughly customer oriented if it is to avoid astigmatic policies that lead down a suicidal path. Making the world's greatest and cheapest buggy whips saved nobody from the fatal inroads of the automobile revolution. Making the world's best and cheapest vacuum tubes will not keep you from being destroyed by the versatility of the more costly transistors. Doing the best customer-serving job of dry cleaning and finished-product delivery will not protect you from serious loss of business to the wash-and-wear revolution. **Similarly, being the world's best electric utility company is no more guarantee of your prosperity and survival than being the world's best kerosene lamp manufacturer was a guarantee of its survival.**

The first rule of survival is that you must define your industry in the broadest possible terms. If you don't, you automatically foreclose opportunities that lie ahead. You automatically tie yourself up with inflexible and therefore suicidal policies.

The way to define your industry properly is to look first at what your customer buys and what she needs. When she uses her Mixmaster, she's not buying electricity, she's buying energy. The same is true of the factory, whether it uses energy to run a machine, to light the plant or to air condition the office.

The customer doesn't care how that energy is produced (or by whom), only that it is quickly, conveniently, flexibly and economically available.

Actually, the customer doesn't want energy at all. What the customer wants is that the Mixmaster runs, that the machine works, that the plant is bright and the office cool. Energy is a necessary condition, but not itself a satisfying one.

The power image: A customer becomes aware of the energy provided by the utility

People can't see it, can't touch it, can't smell it and can't taste it. It is a phantom product. They can't get very excited about it one way or the other.

The consumer has no strong attachment to the product the utility produces

The Power Image

There are only three situations when they are aware of the energy provided by utilities, none of them pleasant. One is during a power failure and then, instead of counting the blessing of its quiet and uninterrupted availability during normal times, they curse their brief inconvenience and the failure of the utility company to restore service immediately.

The other time they are aware of it is when they get their bill. Since the product has no tangible reality they can't fondle it fondly and admire the good buy they got for the price. Nobody feels very endeared to a ghost, especially when its value is so ambiguous.

Finally, people are aware of electricity when they see their neighborhoods vulgarized by power lines and utility poles.

All this means that the consumer has no strong attachment to the product that the electric utility industry produces; that he is actually in a receptive mood for alternative ways of getting energy. This is an enormously important fact, not just a piece of conjectural fancy. A phantom product is a vulnerable product. People can feel, see, play with, and personally identify with a car. They won't accept substitutes very quickly—not even eminently sound ideas like monorails for commuters. But electricity! Who cares? Just so long as the house is bright, the gadgets work and there's no trouble getting and keeping it.

A rechargeable storage battery or fuel cell sitting silently in some

closet and ticking off energy for the entire house might be much more attractive than the way energy is now provided. Or perhaps solar energy is more convenient and reliable. Both ways offer benefits and advantages that present methods do not. And both are fairly near-term possibilities.

Dozens of American, British, Dutch, French and German companies, as well as Soviet laboratories, have made enormous progress in developing silent, smokeless, nonheating power plants of modest sizes and enormous output. The most advanced work is on the fuel cell, though there are other possibilities with different kinds of attributes, such as thermoelectric generators, thermionic generators and magneto-hydrodynamic converters.

Aside from the obvious customer-serving potentials of these power systems and their potential for providing each home and plant with its own silent power reservoir, two other highly significant facts stand out. One, the companies actively doing fuel cell research cover a wide spectrum of industries, including automobile manufacturers, oil refiners, battery companies, electronic companies, chemical companies, electric machinery companies, independent laboratories, the U. S. government, and even a hearing aid manufacturer. This proliferation of industries working in this area is of the greatest significance. It means that the heavy competition which the electric utility companies face is no longer limited to natural gas. A lot of other industries are pursuing new customer-serving profit-building alternatives to the present ways of delivering energy to the customer. One of these days, while everyone else is speculating about the possible impact of atomic-powered central generators, there will be wholesale break-throughs on another front to obsolesce everything that now exists.

This leads us to our second point. If all these companies are making this kind of progress on fuel cells and other power systems, what should the electric utilities be doing? Since their entire assets and know-how are tied up in the present way of generating and delivering energy, should they therefore try to protect these investments by improving what they already do quite well?

The answer, I believe, depends not on how much you have invested in the present, but on what best serves consumer needs in the future. The most important thing today is to avoid the disastrous astigmatism of the buggy whip and the railroad companies. **The important thing is to get in league with the customer, to work at developing those things which best serve him as he sees his needs, not as they are seen by electric utility companies** with their understandable bias in favor of their own present way of doing things.

When he first bought the automobile, the customer bought a more complicated and more expensive and even less reliable mechanism than he'd been used to. But no amount of stentorian logic by the buggy whip manufacturers persuaded him of his alleged error. The customer buys more expensive and harder-to-store frozen pies, and no amount of argument by the corner baker keeps

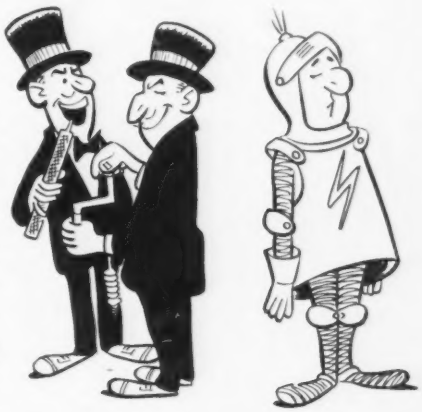
Wholesale breakthroughs on another front may obsolesce everything now existing

the trend from accelerating. He buys unbelievably complicated and costly computing machines when a reasonably bright college senior could show him that with less money and less upheaval he could get greater benefits if he only reorganized a few departments and bought some relatively inexpensive and simple accounting machines. But no, he goes his self-willed way. And so it goes everywhere.

What the electric utility companies must obviously do, either individually as a few have done with the fuel cell, or collectively, is to thoroughly and enthusiastically research alternative power systems. **The fact that they would be joining their enemies in jeopardizing their present investments is entirely beside the point.** The work of numerous other industries is already plotting the obsolescence of electric utility companies as we know them today. Hence they have no choice but to join their competitors in the search for what will probably be a customer-serving improvement. If they join the search they have a chance of continuing their present role of supplying energy. If they don't, they may find themselves as prostrate 50 years from now as the nation's railroads have become. The age of the swaggering big business tycoon is gone, and not because we have run out of diamond stickpins, gold watch fobs and beaver top hats. **It is gone because those giant men of consummate energy, imagination and cunning who created this symbol of America's Promethean business prowess—the great railroad master builders of the past—these men took with them to their graves the kind of comprehensive imagination that made the railroads great and American capitalism the triumphantly audacious organism of economic experimentation and productivity that we may no longer be.**

If the utilities are going to do the kind of basic energy research that's needed for their survival, they can't make it just a token or grudging activity. It has to be vigorous, dedicated, and involve an all-out long-term commitment. If it isn't, there will be failure.

The railroads again are a good example. In the 1920s some of them tried to get into the airline business but the Interstate Commerce Commission kept them out. Others got into trucking, waterway shipping and bus-line operation. Later one of them effectively got into oil pipelining. But in these early efforts to get into other lines of transportation the companies didn't really do it with vigor and enthusiasm. They did it negatively, to slow others down, not to accelerate their own growth.



Other industries are already plotting obsolescence of electric utilities

When the authorities turned them down they didn't really continue the fight, because they didn't really want to win. And when they did continue it, it sometimes looked more as if it were for the record than for keeps.

Getting vigorously into fuel cell and other research is not just a defensive idea. It must be viewed as a positive act of entrepreneurial push.

The fuel cell has enormous growth and business-building possibilities. One electric utility that is already doing new power plant research has helped develop an electric storage battery designed to operate automobiles. At night the motorist simply plugs the battery into an electric outlet in his garage and this recharges the battery for use the next day. In this way the utility hopes to create a big market for its off-peak generating capacity.

Now offhand this looks like a really shrewd notion. It certainly would pull in the profit. The fellow who thought it up is a smart manager because he knows that keeping the

The basic energy research needed for survival can't be a grudging activity

overhead fully productive 24 hours a day really pays off. The fellow who invented the battery is a smart engineer, and that's what we need more of, smart engineers.

But the fact is that what really stands out here as the genius idea is neither of these two. What is really smart is the realization that gasoline is a phantom product that people don't really want. What they want is the use of their cars. They don't like stopping at gas stations because they don't get anything except held up from going quickly to where they want to go. They hate to stop for gas. Hence the idea of enabling them to run their cars without irritating gas-station stoppages is enormously appealing, and that's what makes the overnight rechargeable automotive power plant such a powerful idea with such powerful possibilities. People **really** want it.

The fuel cell would also make energy easily available in remote or inaccessible areas. It would create a market for itself in numerous ways and places where electric power is not now available.

Lesson From Ma Bell

The utilities should take a lesson from the American Telephone & Telegraph Co. Here is a natural monopoly, as eminently qualified for nationalization as the post office. Yet contrary to the electric utility companies, nobody ever proclaims AT&T's eligibility for government ownership. The reason is its successful profit-making formula of uncompromising devotion to taking care of the customer's needs. Here are the rules laid down by Theodore Vail, Mother Bell's president over 60 years ago:

1. *Dedicated, no-quibbling, all-out and dignified service to the customer.* Nothing would not be done, no excuses were to be offered, and in the company's direct contact with customers they were to be treated with royal regard and served with dispatch.

2. *AT&T was to undertake a continuous and vigorous program of product improvement and communications innovation—bringing the results to the public as fast and as cheaply as possible.* While American railroads sat back, fat and self-satisfied as airlines and trucks stole their business, AT&T, with no competitors, was being restless, creative, productive and an enormously good provider.

3. *The company management was to make it an uncompromisable duty to provide service wherever it was demanded, regardless of difficulties and cost; and it was to assume the obligation of finding the necessary capital and making the necessary profit to do the job—without running to government for subsidies and handouts.*

The merits of this policy are magnificently self-evident. The company viewed itself as being in the communications business, and it got into it enthusiastically. The Bell Laboratories have created numerous technological break-throughs. Western Electric Co., its manufacturing subsidiary, has been a supplier that makes for AT&T what AT&T, not some outsider, decides it needs and wants. And when it comes to the most minor details of in-home telephone or plant-to-plant microwave service, Bell is not only on the job quickly and efficiently, but more important it produces a constant stream of product and service innovations for the benefit of its customers. **The result is not only greater customer satisfaction, but actually customer creation.**

When it comes to technological innovation, product development and service improvement, electric utilities have a rather dismal record. They have relied almost completely on their suppliers to do the industry's research and innovating. They have relied almost completely on appliance and machine companies to create and expand the market for electric energy. They have let fast-talking housing developers call the tune on power-line installations, with the result that they are usually aboveground, where they hurt the utility companies in two ways: they are more prone to service interruptions and they vulgarize the neighborhoods, for which the utilities get the blame.

An industry that waits on others to create and maintain its market is headed for trouble. An industry that does not systematically explore all the possibilities of customer service, no matter where these lead, is headed for trouble. An industry that thinks of itself as producing a narrow product or a specific service rather than a broad spectrum of complex customer satisfactions—such an industry is headed for trouble. And an industry that has all these failings all at once, such an industry is a dead-sure candidate for early obsolescence, no matter how invincible it now looks. This conclusion is not my judgment. It is the judgment of history.

Ma Bell has a successful profit-making formula of uncompromising devotion to customer needs. The result is greater satisfaction and actual customer creation

Barred from the discussion of market problems with competitors by law, plagued with overcapacity, whipsawed by foreign competitors, the electrical manufacturing industry has plunged into a pricing conflict. Whatever the cause, our industry had best begin reckoning with the results. To get the facts, the editors of Electrical West have asked a cross section of the industry penetrating questions about . . .

PRICES, PRODUCTS AND PROGRESS

An Electrical West Staff Report

The facts presented in this survey represent the combined thinking of the top management of 20 of the leading electrical equipment manufacturers in the country. With the statistical facts are pertinent comments that have been received.

These comments have been condensed for clarity and to protect the respondents' anonymity. Every effort has been made not to color the facts or to use them in support of preconceived ideas.

Our efforts at objectivity have been aided by the candor and honesty with which these in-the-bind managers have responded. Without crying, complaining or finger pointing, they have recognized the two-sided nature of the problem. No Pollyannas, they are taking action—coming up with answers that enable them to exist and make a profit. But the answers affect their products. And products affect users. Here then is a forum on prices, products and progress.

I — Capital Expenditures

	Yes	No
1. Have you canceled or set back any plans for new plant expansion as a result of the present price profit situation?	17%	83%
2. Have you canceled or set back plans for modernization of facilities?	22	78
3. Have you postponed tooling up for new products, the designs for which have already been completed?	22	78
4. Are you contemplating dropping special products out of the line and concentrating on the production of only those that are money makers?	72	18
5. Have you begun to use or consider using foreign components as a means of meeting present price levels?	28	72

One trend is clear. Manufacturers will not carry special products or full lines of products unless they make money. Here's what they say.

"We have stopped manufacturing items which do not pay overhead plus a reasonable profit. We thus have lower sales volume but bettered profit."

"We have simplified the products and simplified the line to hold down costs by eliminating the whimsical frills of individual buyers."

The responses to the other questions require some analysis. How serious is it that 20% of a representative sample of the industry has set back expansion, modernization and retooling? The maxim that "as capital spending goes, so goes the nation" as set forth by McGraw-Hill economists should give us cause for concern.

Is it significant that 28% are looking to foreign sources of supply as a means of making profit at today's prices? Remember, these people are power customers.

On the subject of foreign supply, industry managements were vocal indeed.

"We have made surveys of the availability of foreign materials, components, tooling, etc., in case such competitors turned to such sources, and we are compelled to follow suit in order to maintain a profit margin in our business."

"If the present tendency in utility buying persists, I am sure that you will find Europe and Japan outstripping us in technological advances and in heavy electrical machinery."

"We have not seriously contemplated the use of foreign components for several reasons. (1) The lack of control of foreign suppliers; (2) the feeling that if we buy foreign components we have no reason to complain if our customers buy foreign components; (3) the confidence that we can get our employees' support in trying to keep jobs here; (4) the feeling that if jobs continue to be exported preventive legislation will surely follow."

II — Research

	Yes	No
1. Has the emphasis in your researching development shifted materially from product improvement to cost reduction activity?	72%	28%
2. Has the price situation caused a reduction in R&D expenditures?	41	59
3. Have you dropped or furloughed any research people?	38	62
4. Have you shut down any research facilities or cut back on plans for expanding new research facilities?	17	83

A clear trend to R&D as a cost cutting tool: 40% of the companies cutting R&D expenditures, laying off researchers; 17% holding back on capital expansion for research. No reasonable member of the industry can infer long-term benefits for anyone from this picture. Exceptions—some have increased R&D as a competitive measure. Here are the comments.

"We are actually increasing our R&D activity, which is directed both on new products and cost reduction activities that do not affect quality. We have postponed the modernization of one of our laboratories."

"We have placed most emphasis on getting our regular line redesigned and in a most competitive position."

"Once we thought we couldn't afford an R&D department—now we feel we can't afford to do without it."

"We are carefully reviewing capital expenditure requests for R&D facilities and equipment to make certain they are absolutely necessary."

"Continuation of existing price levels will eventually result in curtailment of R&D."

III — Engineering and Production

		Poorer	Better
1. Will efforts to design to existing price levels result in better or poorer products from the user's viewpoint?		93%	7%
	No Change	Increase	Decrease
2. Have you increased or decreased your engineering staff?	42%	23%	35%
	No Change	Yes	No
3. Have you decreased your engineering field staff?	53%	18%	29%
4. Has the price situation encouraged automation in your operation?		74%	26%
5. Is the profit squeeze tending to reduce the number of quality control points in your production line?		7%	93%
6. Which school of thought do you subscribe to —			
1. Keep factory operating by taking business at whatever prices are necessary?		8%	
2. Shut down factory operations that cannot contribute to overhead and profit?		92%	

Here is the heart of the problem from the user's viewpoint. **Present design efforts will result in poorer products.** How these poorer products will perform, what added maintenance costs will be, only time can tell, but message is clear. Looking for bright spots it is possible to point to increased automation as an improvement that should result in reduced costs at no sacrifice in quality.

"We have substituted hot molded for cold molded parts, reduced copper content, and selected lighter gage steel."

"Material substitution such as malleable iron for brass is the most significant step to date. Reduction of reserved capacity will follow a continuation of existing prices."

"All designs are being reviewed to find ways of reducing cost without sacrificing performance."

"We are reviewing products carefully from all angles with the intent of reducing costs but we are determined not to lessen the value of products to our customers."

"Products are being designed closer to name-plate ratings."

"All cost reduction programs are now well into the area of diminishing returns. Continued price pressure would become costly to our customers."

"We are reducing safety factors, eliminating frills and substituting materials."

"We have an all-out program to reduce costs. Suppliers are being called in to work with our engineering department on cost reduction."

"We are substituting materials where possible and are reducing the size of equipment. Some of the reductions are radical enough to be shocking."

"New products are being designed which incorporate all minimum NEMA standards. Conservative design and plus features are being cut back."

IV — Marketing

		Yes	No
1. Do you think there are indications that a return to normal prices will come in 1961?		11%	89%
	No Change	Inc.	Dec.
2. Has the price situation caused you to increase or decrease your total marketing force?	50%	25%	25%
		Yes	No
3. Are you reducing factory inventory of completed goods?		65%	35%
		Yes	No
4. Have you reduced district office stock or field inventories?		50%	50%
5. Will the present price situation affect your contribution (men, money or time) to such things as NEMA, standardization programs, etc.?		76%	24%

In the marketing area, there is additional bad news. Ninety per cent of those surveyed do not predict a return to normal or so-called book prices. Few felt there was much possibility of further deterioration—just a bottoming out at prices perilously close to costs.

From the user's viewpoint stocks at the factory and in district warehouses will shrink—probably an average of 15%.

On the subject of who is to blame for the prices two viewpoints appeared.

"Although I have a substantial regard for those giant elements in our industry in some respects, I am grossly disappointed that they have not furnished the industry with leadership and statesmanship in the market place."

"The squeeze is on us from little companies who support no research and development."

Other comments in this marketing area indicate '61 will see conventions, entertaining, industry activities carefully screened. Anything goes if it will sell—at a profit.

"Many standards are being ignored so it appears to be a waste of time and money to send people to help make more standards that will be ignored. The 55/65 rating of transformers is an example."

"We are watching our overhead costs closely. We can operate as long as anyone even if it means no profit."

"We're concentrating on selling—the extra curricular activities are likely to take a large cut."

"We intend to take a far closer look at expenses for meetings and conventions."

"We don't deliberately take any business at a loss. However some marginal business can be accepted profitably."

"Continuing reduction of costs and selective pricing have enabled us to continue to show a fair profit."

V — General Questions

What are the over-all negative effects from the user's standpoint?

"Reduction in quality and services, elimination of some sources of supply."

"Reduction of safety margin now existent in present equipment. Possible loss of suppliers, loss of the flexibility of the survivors."

"The users will have to find this out—the hard way. Progress and new products are being curtailed and will probably result in the elimination of some worth-while companies; ultimately reducing competition."

"Instead of buying to a high standard set by an outstanding company, users are now buying the lowest standard set by any acceptable competitor. Continued low prices lead to lower quality and poorer service."

What beneficial effects can come out of the soul-searching that is going on on the part of the supplier?

"In some instances purely excessive design features have been eliminated in order to reduce cost. This has actually improved the products in several cases."

"Awareness of inefficiencies, elimination of weight and increased automation."

"Needless fringe expenses can be cut. Each operation will be re-examined to clean out any bad operating habits that they accumulated during the past several years."

"Better methods, reduction of excesses within organization, more dynamic management."

"Wonderful! Everything can be done better, at lower cost and more intelligently. Also recognition by labor that the employees' problems are also labor's problem."

"Possibly some economy in materials and design."

"Accumulated organizational fat can be eliminated, but the pressure is so severe we're getting perilously close to the bone."

"Today's market will force lower costs and a new pricing basis will evolve."

What steps should be taken to improve the situation?

"The industry should analyze their costs carefully and establish a fair ratio of profit. Once we learn that we can't give it away we'll probably sell it. We have to use self-restraint and not quote prices that are below cost."

"Sales managers can do a great deal to prevent the industry from losing its head by not acting recklessly on the basis of information fed back to them from the field."

"Unless reasonable profit characteristics can be returned to the electrical equipment industry, it is doubtful that this industry can continue to attract and hold competent men. This is true of investors as well."

"We should publish day to day prices just like stock market prices. Companies should sell at reasonable prices and let other companies take business in which they are better."

"We should price realistically, eliminating the possibility of white sales thereby instilling confidence on the part of the user."

"Nothing can be done until suppliers have the intestinal fortitude to grow up and think like intelligent businessmen. We must stress the reduction of quality required at the present prices."

ECONOMIC APPRAISAL OF THE WEST

WILLIAM J. BROWN, McGRAW-HILL ECONOMIST

Shrugging off the business lethargy that has gripped the rest of the nation, the 11 Western states have enjoyed good increases in the earnings of factory workers and in total personal income during the past six months. Thus, Western consumers are equipped for a high rate of spending in the months ahead. Total personal income rose 10% in the 11 Western states between the last half of 1960 and the same period last year. In addition, industrial building contracts jumped ahead sharply and the weekly paycheck of factory workers rose 3%.

Income

As usual, the income of Western consumers is growing more rapidly than in the rest of the country. During the last half of 1960, personal income in the 11 Western states ran 10% higher than in the similar period of 1959, contrasted with a 7% gain for the country as a whole. Thus the incomes of Western consumers are growing 40% faster than the national average is growing.

Construction

The industrial construction picture in the Western area is much brighter than it is nationally. The contract awards for the area were swollen an unusually large amount by a contract award for a large pipeline project but construction of all types of new industrial buildings is running at a fast clip. Contract awards were up 149% for the West, vs a 4% gain for the entire country.

And residential construction is faring better in the West also. Continuing high interest rates in the third quarter helped hold down residential construction all over the country but the influx of people to the West has held the decline in housing starts to a smaller figure than for the whole country. Comparing the last half of 1960 with the same period last year, residential nonfarm housing starts in the West were off 4% while they were off 6% nationally.

Electric Power

Statistics on electric power production in the West have been cheerful for some time now, and they continue that way. Electric power production (by utilities) is growing at roughly twice the rate in the West that it is nationally. For the last six months of 1960, electric power production in the West was up 9% over the similar period in 1959, while for the nation the gain was only 5%.

Outlook for the First Half of 1961

The economic pendulum swung from high to low in the second half of 1960, and a continuation of sluggish business conditions is expected during the first quarter of 1961. During the second quarter of 1961, the economy should begin to gain speed again and, by the middle of the year, a decided upswing should be in progress. Taking into account the fact that business will be down a little in the first quarter of 1961, and on its way up during the second, the average for the first half of 1961 should be only slightly below the last half of 1960.

Since economic activity in the 11 Western states now has a good head of steam, the general downturn in business should be less noticeable in the West than elsewhere, but only a few segments of the Western economy can look forward to substantial gains during 1961. Moral, the West is in clover—relatively.

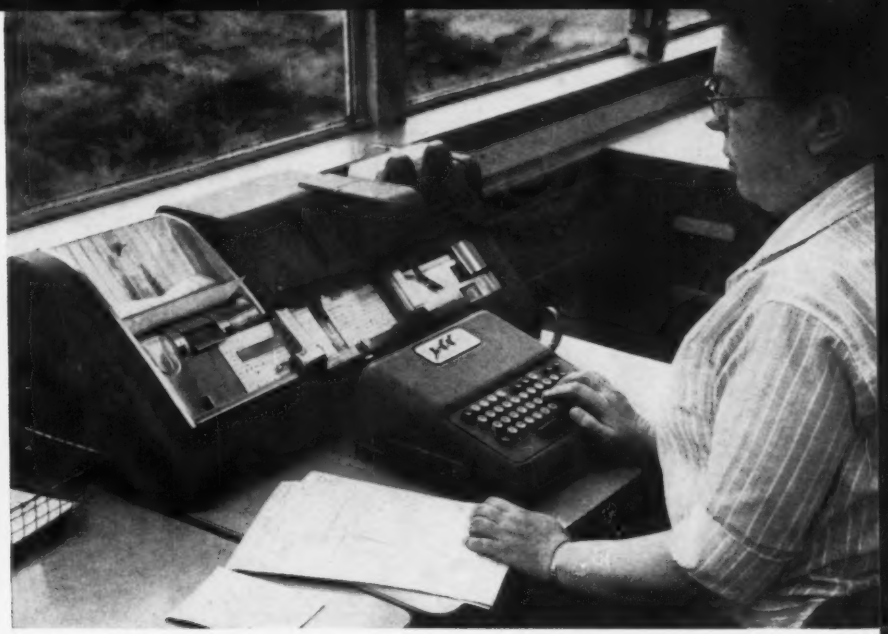
10 Key Indicators

	WESTERN STATES				TOTAL U. S.			
	2nd half 1959	1st half 1960	2nd half 1960*	% change 2nd half '59 to 2nd half '60	2nd half 1959	1st half 1960	2nd half 1960*	% change 2nd half '59 to 2nd half '60
Personal Income (billion dollars)	5.31	5.73	5.86	+ 10	32.02	33.53	34.25	+ 7
Total Nonfarm Employment (millions)	7.82	7.80	7.90	+ 1	52.28	53.00	53.01	+ 1
Manufacturing Employment (million)	1.94	1.89	1.96	+ 1	16.23	16.53	16.31	0
Other Nonfarm Employment (million)	5.88	5.91	5.98	+ 2	36.05	36.47	36.60	+ 2
Department Store Sales Index (1947=100)	157	156	158	+ 1	145	144	147	+ 1
Housing Starts (nonfarm — thousand)	30.0	27.7	28.7	— 4	126.2	109.2	119.0	— 6
Industrial Building Contracts (million dollars)	35.0	55.5	87.3	+149	326.5	297.8	338.0	+ 4
Weekly Earnings in Manufacturing (dollars)	96.13	97.53	98.94	+ 3	87.67	91.15	90.91	+ 4
Initial Unemployment Claims (thousand persons)	43.5	49.5	57.0	+ 31	251.5	281.1	323.0	+28
Electric Power (billion kwh)	11.63	11.98	12.69	+ 9	60.66	61.61	63.80	+ 5

Sources: Employment, Unemployment, Weekly Earnings: U. S. Dept. of Labor; Personal Income: Business Week; Department Store Sales: Federal Reserve Bank; Housing Starts: Census Bureau; Industrial Building Contracts: Engineering News Record; Electric Power: Federal Power Commission.

* Estimated by McGraw-Hill Department of Economics.

Dave Johnson, stores supervisor, says less working capital is now tied up in inventory



Source documents reflecting transactions affecting inventory balances are routed to stores office in Spokane. After checking and coding, data are punched into cards

IMPROVED CONTROLS CUT INVENTORY 25%

ALLAN F. ELDER, TREASURER, WASHINGTON WATER POWER CO.

Improved inventory control techniques have sliced at least $375,000 from the amount of working capital that Washington Water Power Co. must tie up in inventory. This amounts to 25% of the $1,500,000 total average of the stores inventory.

The healthy saving was accomplished by discontinuing a record-ledger method of control and consolidating inventory records for 18, now 20, storerooms into a well-controlled punched card procedure. Most of the manual arithmetic and other clerical work involved has been taken over by the utility's IBM data processing section.

Actually, the 25% reduction in inventory value is a conservative figure. Before the system was installed in 1956, the company's inventory contained 3,700 items and was valued at $1,260,000. Since then, the number of items has risen to 7,500—more than double the 1956 figure. Had the value gone up proportionately, it would now exceed $3 million.

However, the data processing installation has enabled us to hold

Transaction cards are merged behind previous inventory balance cards on collator in the machine center. Then . . .

. . . merged cards are run through 604 electronic calculator, which automatically updates balances for each item in inventory

Stock status reports are printed at the end of each month on a 407 accounting machine in the Washington Water Power system

Heart of the WWP inventory system is this tub file of IBM cards, which includes a master card for every item in inventory in each of 20 storerooms

the over-all value to $1,500,000, an increase of only $240,000, even though the total figure includes additional items worth $266,000, acquired through Washington Water Power's 1958 merger with the Spokane National Gas Co.

Turnover—often deceiving in the industry because of disturbing factors such as special construction projects—now is at the healthy rate of 3½ times a year when operations are normal. This is about the same as when the stores data processing system was installed in 1956, when construction inflated the turnover rate and when we had half the present number of items. With mechanization, the increased traffic has been handled without any increase in personnel in our stores department.

Economics in inventory fit into a company-wide pattern of increased efficiency achieved through centralization. The over-all plan, several years in the making, neared completion in 1958 when a new $7,500,000 operations center in Spokane's Mission Park District was occupied by the company.

Despite the recession of that year, we were able to increase per-share earnings from $2.44 in 1957 to $2.49 in 1958 on operating revenue of slightly more than $30 million.

The inventory system, which has made a major contribution to our improved operation, mechanizes the handling of some 12,000 inventory transactions monthly. It eliminates much of the possibility of human error – particularly in the area of inventory arithmetic. Most important, it puts vital inventory facts before us for study as soon as they require attention. There is no serious lag between receipt of data and its reflection on inventory records. Decisions are made on the basis of current information.

Stocks of items that fall within 10% of a reorder point are spotted mechanically, without fail. Necessary orders are issued without delay. There are fewer overages and shortages of stored items.

Establishment of the now-proved system for controlling inventory made it possible to lower the minimum levels of stocks held in inventory on the basis of solid historical usage records. Stores personnel has gained confidence in the system, and there has been less compulsion to hedge against eventualities by a build-up of stocks.

As soon as any special project (construction or otherwise) is announced, which creates a need for abnormal stocks of certain items, these requirements are entered into inventory. IBM machines compare the requirements to the stock on hand and immediate provisions can be made to meet needs.

Each time an inventory is updated, a reorder list is printed by one of the IBM 403 accounting machines. This lists each reorder item by stock number, last purchase order number and storeroom where it is needed. It describes the item, reports the quantity on hand and the pre-established minimum reorder quantity, reports any orders outstanding, and shows the number of issues both in the current quarter and in the corresponding quarter a year ago.

A complete stock status report is printed mechanically at the end of each month. In the same detail, this report shows the exact on-hand balance, on-order quantities and requirements against every item in storage, by storeroom.

In addition to the operational advantages of the punched card system, numerous benefits were realized in the realm of general accounting. The same transaction cards that are used to up-date the quantitative stores inventory value file are used for accounting purposes.

These "costed" cards make it possible mechanically to charge material accounts in the general ledger and to distribute charges from inventory to work orders and general ledger accounts involved when materials are drawn from inventory.

Once each month, the quantity and value inventory cards are combined and checked for accuracy. Discrepancies are adjusted. Quarterly a costed or priced stock status report is run.

At the end of each month, a "source journal" is written, which breaks all issues down by accounts and departments to which they are charged.

The heart of the inventory system is a tub file of cards in the stores office at Spokane. There is an item master card for every item of material or supply in each storeroom. In effect, there is a separate file of item cards for each storeroom.

At any given time, a stores clerk can look at a particular item card in the section for any storeroom and determine current levels of materials in stock there. Physically, these storerooms are scattered over an area that includes most of eastern Washington and northern Idaho, and touches Montana.

All paperwork affecting inventoried materials clears through the stores supervisor in this office. He approves requisitions for purchase of supplies, first determining whether needs might be met by transfer from one storeroom to another. Copies of purchase orders, issued by purchasing, go to his office and are checked to the reorder list.

Other types of source data report-

ing inventory transactions include vendor invoices, reports of materials received, tickets reporting issue of materials from stock, material transfer and adjustment reports.

For every transaction document, a card is punched on an IBM card punch in the stores office. In updating inventory records, both the current transaction cards and the complete inventory files are sent to the data processing section.

The main storeroom inventory is updated every other day and the outlying storeroom inventories are updated once a week on a cycle basis. Updating is a relatively simple machine processing job. Cards first are sorted to stock or item number order. Then a collator automatically selects from the master file the cards for stock numbers, which are represented in the groups of transaction cards. All transaction cards for a given item number are merged behind the master inventory card for that number. On a second pass, a blank master inventory card is filed behind each number; this will become the new balance card.

The cards then are run through a 604 electronic calculator. This 604 machine computes the new quantity on hand (adding receipts or returns and subtracting issues) for each item and determines whether this figure is within 10% of the reorder point punched into the master card. If it is, the machine makes a special X-punch in the new balance card that it punches. On a second pass, the calculator figures the net amount of issues of each item in the current quarter and punches this in the new balance card.

X-punched reorder cards are picked from the deck by a sorter and the reorder list is run on an accounting machine. New balance cards then are interpreted (printed for visual reading) and merged into the existing master inventory file. The updated file then is sent back to the stores office.

Working from the reorder list, the stores supervisor initiates the necessary Repeating Requisition to Purchase Material forms.

The detail transaction cards for receipts—one for each line item—are held to the end of each week. Then they are used to update the value file. Cards collected through the week are sorted to stock number and merged with the file of value master cards. On a second pass, a blank value master card is filed behind each stock number. The value masters, incidentally, are not in storeroom order. Since the function of this file is to control the value of total inventory, there is only one card for each item in inventory. It contains a figure for the total combined value of all items of that number in our inventory at all locations.

Virgil E. Bendix, supervisor of the company's data processing section, says inventory processing takes less than 5% of department's machine availability

Following this merging, the 604 calculates the new value for each item and, by division, the new unit price. It checks this product to determine whether there is a 10% change in unit value as a result of the new calculation. If so, the machine stops and a check is made to determine whether there has been a mistake or whether the item simply has changed that much in price since the last order. In addition to figuring value changes for the master file, the 604 punches a unit value into each transaction card representing receipt of material. New updated data are punched into the blank value master cards.

The transaction cards, now containing unit price, are run through an IBM accounting machine to print a tabulation of all receipts during the week. This tabulation list is sent to the stores department and filed in folders by storeroom.

At the end of each month, the stock status report is produced by running all updated quantity inventory cards through an accounting machine.

Once each quarter the quantity file is reproduced and the duplicated cards are combined with the value masters. These go into the 604 calculator, which computes and punches the unit price and value into the cards reproduced from the quantity inventory file. The machine accumulates the quantity of items from these cards and compares them to the quantities in the value master cards. If there is a difference, corrections and/or adjustments are made. When in balance, a priced or costed stock status report is printed.

The punched card system also has simplified the problem of physical inventory. Inventory tags are printed in advance of a physical inventory, which is taken once yearly for each storeroom. These contain blanks for differences, reasons, etc., when the physical count is compared against totals in duplicate master item cards. When the tags are completed by the internal auditor's staff, adjustment cards are punched from them to bring both the quantity and value records into a balance with the physical count.

In all, inventory processing time probably accounts for less than 5% of the rental charge in our data processing section. Since mechanizing the stores inventory, the stores office staff has not increased, even though the number of items handled has more than doubled, and no additional IBM equipment has been added. Rather, mechanization has improved the over-all utilization of the equipment.

Discussion continued into the coffee hour, held outside in the pleasant setting at the Safari Hotel in Scottsdale. Above, visitors from Hawaii, George Hogg (right), Hawaiian Electric vice president and treasurer, and Herbert Heinrich, commercial manager, stop for a chat by the swimming pool

Communications, public relations, methods and practices discussed by

ADMINISTRATIVE SERVICES GROUP

It was a well organized program with good speeches and thought-provoking discussion." This comment by one of the delegates at the Administrative Services Conference sponsored by the Pacific Coast Electrical Assn. and the Pacific Coast Gas Assn. probably was echoed by many who attended the sessions at Scottsdale, Dec. 1 and 2.

To leave plenty of time for full programs at the five parallel meetings, general sessions were limited to the two luncheon talks, both well attended. Kinsey M. Robinson, chairman of the board, Washington Water Power Co., the first day's speaker, gave sound advice in his address, "Mind the Competition." Stating that most of the industry's failures can be traced to mistaken judgment of competitive situations, he said that apparently we have talked about the wrong things, or occasionally have offered nothing more than a variety show on national television. Meanwhile our competition has been talking about local control, service without profit, which means lower rates; has built a credible story about Wall Street's greed and exploitation of the little fellow.

Robinson believes that all of us can do more market analysis and that reliable data—true facts about our competitors, whether public power, government encroachment, coal, oil, travel, clothes or tobacco—can be set up as a challenge. He cited advice of a boss more than 30 years ago: "Run your business like you had a competitor across the street to whom your customer could go any day."

Stating frankly that his aim was to shock, not to placate, Joseph L. Tucker, deputy chief, Plans and Management Division, Directorate of Materiel, Norton Air Force Base, gave the Friday luncheon audience a look at the future. Within four or

H. F. Hartzell, PCEA president, visits with Kinsey Robinson, WWP board chairman, and H. G. Dillin, executive vice president,

San Diego G&E; at right, with J. H. Mead, vice president of Edison company, and President Walter T. Lucking, Arizona PS

Co-chairmen W. T. Quinsler, Arizona Public Service, and W. E. Johns, PG and E, talk with Joseph L. Tucker (center), Friday luncheon speaker

D. R. Marquis, IBM, with L. C. Jantz of California Electric Co., Purchasing and Stores sponsor

five years he sees manned-craft landings on the moon and return; beyond 10 years he foresees construction and development of a space fleet; exploration of the galaxy, colonization of an earth-type planet. There is nothing final about the speed of light, he said, and "when we have to do a thing we can."

Our greatest lack today, Tucker thinks, is that we are not prepared to meet older and wiser races. "Man is going to have to learn to adjust if he goes into space." He is not worried, however. "We always have gotten there from here and we always are going to do so." Don't get trampled by trying to oppose it," he advised.

Since it is impossible to cover all the talks in the parallel sessions, the following "samples" are given to indicate the fare presented by the co-chairmen and sponsors.

Building Design and Maintenance

Although little new material has been created in recent years for use in partitions, the old ones have been refined and put to new uses, C. W. Hansen, San Diego G&E, pointed out. The movable wall concept has made tremendous strides; wood has kept its popularity, plaster or gypsum board is becoming one of the more popular materials; metal partitions are available in almost every price range; glass, tile, marble, cast block and panels are used for their decorative qualities.

The tremendous growth and development of fluorescent lighting was outlined by Keith R. McClure, California Electric Power Co., who foresees continued trend to greater lumen outputs per watt of power for decreased operating costs.

Since building costs have risen 62.5% since 1949, designers must concern themselves to see that, when capital is spent, it will produce a facility at the lowest possible average annualized cost over its life, Edgar J. Ross, PG and E, pointed out. To accomplish this, the designing engineer cannot limit his planning to low initial cost but must concern himself with all aspects from efficient utilization to savings in operating expense.

E. M. Byrge, Southwest Gas Corp., Credit and Collection sponsor, and Vic Hartley, PCEA managing director

Credit and Collection

A discussion of the legal aspects of credit and collection problems

Richard K. Miller, PG and E, Utility Economics sponsor (center), with J. S. Cooper, PG and E, and John Geiger, PP & L

E. C. Saunders, San Diego Gas and Electric, Customer Accounting sponsor, right, with Lauran G. Clapp and an illustration of his talk

Section vice chairmen E. F. Hawkesworth, Southern California Gas Co., and D. M. Pritchett, California-Pacific Utilities

Building Design and Maintenance sponsor H. H. Tracy, Southern California Edison, with E. J. Ross, Pacific Gas and Electric

under leadership of Frederick K. Steiner Jr., attorney at law, opened this session. Legal "tools" available, when they should be used; course of action when customers go into bankruptcy; possibility of damage suits from cut-off activity were some of the subjects covered.

A presentation of survey results related to current credit or collection practices; use of collection agencies to collect closing bills were other topics discussed by this group.

Considering the question "Are We Throwing Good Money After Bad?" K. E. Klose, PG and E, commented that a sound and reasonable collection policy applied when the economy is good could well be the best one to continue when there is a slowing up, an adjustment or even a recession. This might be better than increasing expenditures by accelerating or intensifying collection effort, he remarked.

Customer Accounting

"Let's Pitch a Little Woo," a cleverly illustrated talk by Lauran G. Clapp, San Diego G&E, opened this session. Practices and policies must be considered from the customer's point of view, he pointed out. People are apt to jump to conclusions and to the wrong conclusions unless they are informed. How customers feel toward a utility depends on what they know or don't know about it; what the company tells them or fails to tell them; or what someone else tells them. Basically the problem is one of effective communications.

Handling customer inquiries; meter reading, accounting control of security deposits and control of service orders were other topics before this session.

Purchasing and Stores

That there is a wide variation in practices being used was apparent from a discussion of the topic "Power Responsibilities by the Purchasing Department," led by Raymond Hill, Arizona PS. General view seemed to be that rigid organizational structure ideal for all was impractical; that intercompany communications leave something to be desired. Obtaining the necessary lead time was a more acute problem with some companies than with others. It was felt that no standard method for control of supply sources was possible.

In planning for tomorrow's personnel, the most that can be expected in application of any practical program is a percentage increase in effectiveness, Russ Bankert, manager of industrial sales personnel, Kaiser Aluminum & Chemical Co., pointed out. Selecting the right men, both within the company and outside, and placing them in the right jobs is an idealistic objective for which, through improved personnel practices, there should be a constant effort to achieve without ever expecting absolute attainment, he added.

Assuming on the part of management sound organizational planning and relatively accurate forecasting of manpower needs, the first step in fulfilling the future manpower needs is to appraise the existing personnel force. Second, once the status of the existing force is determined, then group and individual training plans should be developed and implemented in light of future organizational and manpower needs. Last, and in this case least of all, to the extent that the personnel appraised program discloses weaknesses in the existing force that are not likely to be corrected through a training and development program and also to the extent that the numbers of men required in the future exceeds the current force, then an outside recruitment program must be undertaken, Bankert stated.

Inventory control through use of management science was given by D. R. Marquis, IBM, who pointed to the savings to be realized by management through proper use of existing data processing equipment in inventory control.

In "A Computer Carol" Roy Jordon, Guy Warner and Kenneth Burnett of General Electric Co.'s process computer department gave a report on past and present utility uses of computers, with a long look into future applications. New concepts and techniques in business data processing, particularly magnetic ink character reading and reentry printing, were explained and their application to utilities defined. In the future computers will provide information for operational and for long-range planning, it was pointed out, with their greatest contribution being made in the latter area.

Economics of Utility Industry

This group, a relatively new one in the section, discussed determination of rate of return, revenues, allowable operating expenses, determination of rate base and the allowance; legal aspects of rate proceedings and public power "income" statements.

In introducing the session, R. K. Miller emphasized the scarcity of formal training in the economics of utility operations. Judging from the interest in this meeting, these discussions are proving to be a valuable addition to the agenda.

► To honor **Charles Foehn,** recently appointed District 9 vice-president of International Brotherhood of Electrical Workers, the San Francisco **Electrical Contractors Assn.** Inc. will hold a testimonial dinner at Fairmont Hotel Jan. 21 in the Gold Room. Foehn was previously business manager of Local 6, the San Francisco union local. **W. J. Varley** is in charge of the arrangements.

ELECTRICAL WEST
JANUARY 1961

CONTRACTING & CONSTRUCTION SECTION

STATISTICS / COSTS / PROPOSED PROJECTS / NEW PRODUCTS / NEWS

LATE NEWS FLASHES

ESO Hearings in L.A. and S.F.

Another set of meetings for considering revisions to the Electrical Safety Orders of the California State Division of Industrial Safety were scheduled to be held Jan. 12 and 13 at 1100 S. Grand Ave., Los Angeles, and in San Francisco Jan. 17 and 18 at 455 Golden Gate Ave., Room 1194. Further suggested revisions resulting from the previous meetings have been prepared in 71 pages of a mimeographed booklet and distributed to interested parties for their consideration and further comments. Comments in writing were urged in the interest of accuracy by Thomas N. Saunders, chief of the division.

Contractors To Get Hot Leads

Leads generated by a big advertising campaign on Guaranteed Electric Comfort Heat started Nov. 29 in Sacramento will be furnished to contractor members of the Sacramento Valley Electric League who want to bid on such work. Those doing so agree to contact each prospect promptly and report back to the Sacramento Municipal Utility District within three days the results obtained from the referral. The prospects are to be qualified and not merely "suspects." The program was announced at the Electrical Construction Section meeting Nov. 16, at which Gordon Richards, Graybar's manager of inside construction sales, San Francisco, was the principal speaker on space heating equipment.

Grounding for Appliances

Citing a growing tendency of the National Code and local ordinances to require compulsory grounding of portable equipment, the

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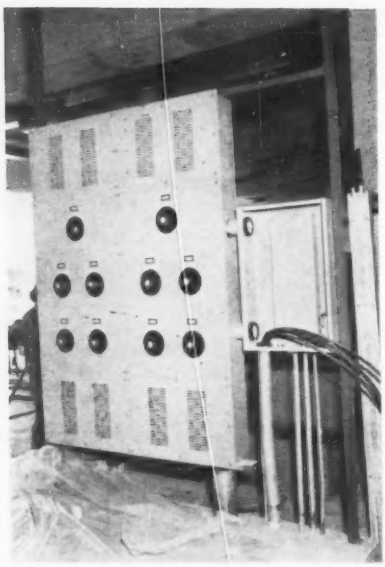
Wiring for comfort and safety at the

ROGUE VALLEY RETIREMENT MANOR



Rogue Valley Manor, located on a hilltop in the eastern residential section of Medford, Ore., like the many similar retirement homes that are being and will be built, relies on electricity to make living better. The imposing 10-story structure is sponsored by three churches—Methodist, United Presbyterian and Protestant Episcopal, and is termed a Christian retirement home. It contains 270 apartments, all but 43 single-room ones containing an electric kitchen; all having electric bathroom heaters.

Almost a city in itself the Manor, in addition to its apartments, has for its resident guests a large dining room, served from an all-electric kitchen, an auditorium, a small chapel, library, game room, a small lecture room, craft and hobby shops and two laundries, one for the Manor, a domestic one for its residents. Its third floor north wing is fitted for an infirmary. Too there's a clinic area, diet kitchen, X-ray and hydrotherapy rooms and a number of single- and two-bed patients' rooms.

Each of the residents' apartments is virtually a Medallion home. In addition to plentiful convenience outlets and compact kitchen, it is wired for emergency call, TV master antenna, telephone and individual apartment heat and air conditioning control. One outlet in each apartment is connected to the emergency lighting system, fed from a motor-generator set that also provides stand-by power for an elevator, hall and exit lights, and other selected loads, including the water pumping plant. The infirmary rooms each have nurse's call, radio outlets, bed lights and even an oxygen outlet. Hospital care short of surgery is provided the member-residents.

Top—Each apartment has receptacles for TV master antenna and power (Jack Goucher wiring outlet boxes to metal studs). Center—Dimmer and lighting panel for the main dining room. Lower—Many apartments have this all-electric compact kitchen

Electrical design for such a building combines what would be required both of a community apartment structure and a hospital. The emergency power supply thus becomes a more important factor and John W. Malony, AIA, of Seattle, its architect, has provided it with a 150-kva diesel-generator and a selective system of distribution to emergency lighting units, motor circuits and the intercommunication system. The electrical installation was made by Trowbridge & Flynn Electric Co., Medford.

To keep poles off the 15-acre Manor grounds, service is taken from California Oregon Power Co. to a pole at the southern edge of the property and down the hill below eye level. Primary at 12-kv Y is brought in on No. 2/0 conductors underground in cement duct to a manhole outside the building and from this manhole into a transformer vault. Distribution voltage is 120/208, four-wire star from the main switchboard to all but the pump house, where 480-v is supplied. No other 480-v is used in the entire building, all other power loads being served by the 120/208 system. A 4,000-amp, three-phase bus runs from the transformer vault to the main switchboard, which has two 1,200-amp, two 1,000-amp, seven 700-amp circuit breakers and a spare in it. Two 250-hp refrigeration compressors for the air conditioning, ventilating blowers, elevators and pumps constitute the major power loads.

In addition to the risers for the

elevator and penthouse blower power there are six sets of risers for the lighting distribution. At each of the 10 floors along each of the latter is mounted a double compartment box or enclosure. One side of its contains the lighting and appliance circuit panel for a section of the floor. The other compartment contains the telephone and intercom panels.

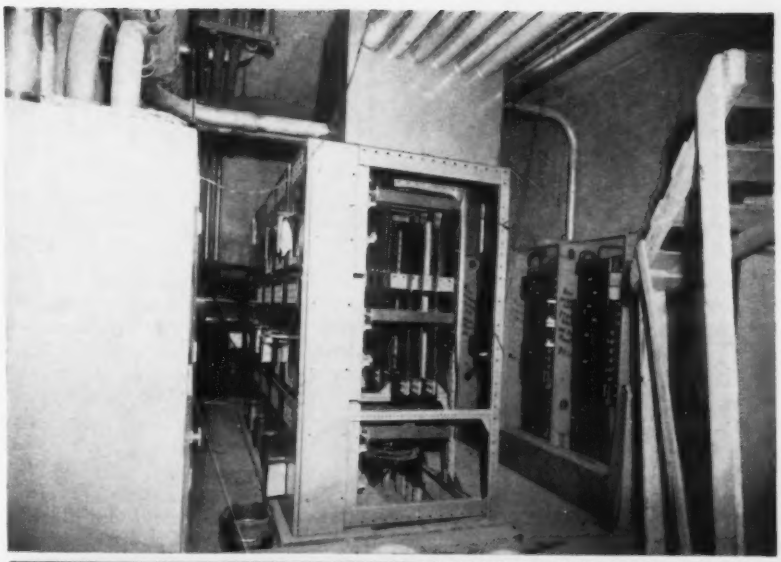
Two 3½-in. aluminum conduit carrying parallel sets of three 500-mcm and one 250-mcm conductors enter each floor's panel at the bottom of a gutter or separate compartment at the right end of the lighting panel. Taps through a bushed opening to these feeders are made with compression lugs to supply the panels. All conductors are copper, the large conduit is aluminum.

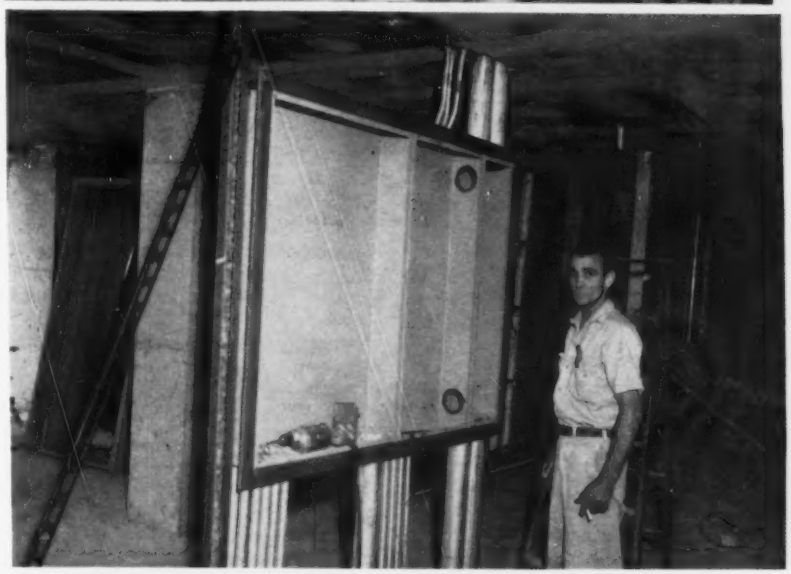
There is a main breaker for each of the panels ahead of the breakers for the kitchenettes, bathroom heaters, lighting and receptacles. Each such panel thus becomes a main distribution center for about six apartments, located close to them for ease of maintenance. These panels are located in the corridor that runs between the apartments, all of which face outward. Spare capacity for future requirements has been allowed not only in feeders and circuits but in all panels.

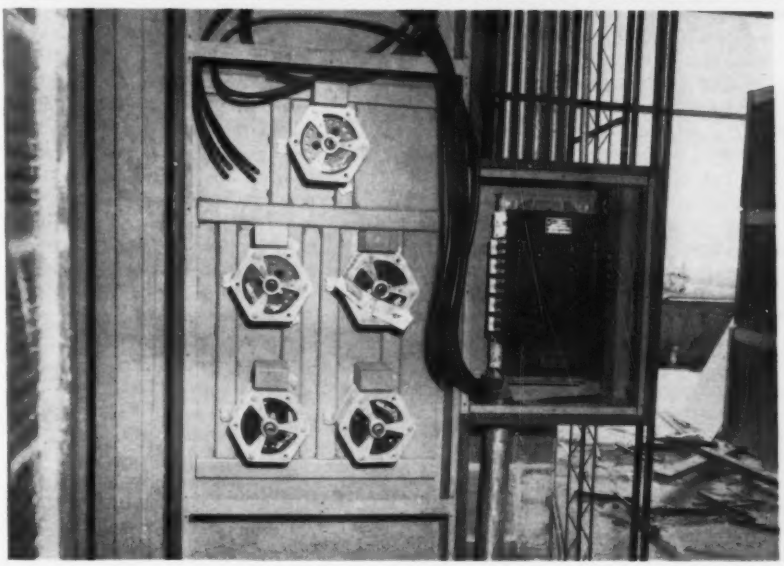
Lighting in the individual apartments is of the residential type, with built-in units in baths, corridors and kitchens, and ample outlets for the resident's own lamps and equipment. In the public areas, such as the lobbies, lounges and dining room lighting and likewise for the auditorium and its stage. Exterior lighting of walks and grounds as well as the entryway has been appropriately executed.

Meals are included in the life-care plan under which the Manor operates. The small kitchenettes will be used only occasionally by those whose apartments include them. Food for the main dining room is prepared in a fully equipped all-electric restaurant kitchen. Diet for those in the infirmary is prepared in a separate kitchen on the hospital floor.

In all respects electric living at its best is assured the retired residents of Rogue Valley's outstanding Manor.







Top — Main switchboard room contains main and riser main disconnects and emergency and power panels. Center—Foreman Art Day at typical riser panel compartmented for telephones, lighting and riser taps. Lower—Dimmer and lighting control panels on the stage of the auditorium on main floor

Adequate conductor capacities for . . .

TRAILER PARK UNDERGROUND WIRING SYSTEMS

GEORGE ACE KOLB, CHIEF ELECTRICAL INSPECTOR, ALBUQUERQUE, N. M.

To meet the ever growing trailer home situation, the city of Albuquerque has developed a calculated chart for use in trailer park electrical design, for underground distribution systems only. It has for its main objective the provision of adequate conductor capacities for such trailer homes, with present and future demand loads upon the system kept in mind.

Going back in the history of trailer occupancies, some 15 or more years ago, we found that mobile trailers were used for transit occupational use, mostly by construction workers and their families traveling from job to job. No provisions were even in the making for code wiring of the trailers themselves. Nor were any provisions made for serving these traveling trailers. The parking of these trailers depended upon such laws of the land known as squatters' rights. Each owner took upon himself the responsibility to find a means to get served by the electrical utility.

As time progressed, the trailer owners grouped themselves in camps. This proved unsatisfactory, because of the lack of sanitation and utility needs. Then came the transition period. Families that were living in houses now found it more economical to buy a trailer and move into a trailer park on a permanent basis, where all necessary utilities were made available.

Cities realizing the need for trailer parks to accommodate mobile homes soon had the task of writing ordinances governing their construction and rules and regulations for their operation. Inspection authorities had a greater problem, for they had no control of mobile home manufacturers in the wiring of these trailers at the factory without code inspection.

Lack of electrical code data as to what constitutes an average trailer demand load and what the minimum permissible voltage drop at the trailer location should be was further complicated. What consideration should be given to the future adequacy of the service and feeder conductors?

For residences, this adequacy provision has been considered in the National Electrical Code. It recommends the use of 100-amp services for residences that rest on permanent foundations. The recommended conductors are No. 2 RHW. Using the same logic and reasoning in sizing conductors to serve two or more trailers, for some have close to the same loads as do houses, a hard and steadfast rule was established that **in no case shall the serving underground conductors be less than No. 2 RHW.**

This automatically takes care of the placement of large or small trailers of variable load demands, regardless of where they may be placed in respect to the serving trailer stations.

Throughout the state, in cities governing by ordinance with a local code or electrical book of rules, allowable voltage drop varies from 1 to 5% inclusive, according to the locality, but no hard and set rules govern.

Here again, using the same logic and reasoning as to voltage drop calculation, we find that the National Electrical Code sets a standard of 1% voltage drop allowance for residential occupancies upon permanent foundations. Therefore the same percentage voltage drop is used for the basis of calculation in the accompanying mobile home trailer chart.

It is important that this 1% voltage drop be not exceeded, if we are to provide adequate conductor capacity for future possible loading. Maintained records show that in each five years the demand load of trailers doubles.

Here in Albuquerque we had as high as six electrical fires inside of trailers. In each case, either a refrigerator or an evaporator cooler motor was involved. Line voltage in each case dropped low enough to cause the motor to slow down, overheat and catch fire. There has never been one trailer fire due to low voltage in any trailer park that has been wired to the specifications set forth in the chart described here.

This chart was designed for direct use. No further calculations are necessary to determine the sizing of the underground serving conductors. But the sizing of the service riser conductors is done by the simple formula that is also shown here.

The service riser may be one single riser to serve from power company aerial drop or option of two service risers in close formation may be used; the one riser may serve the underground serving conductors in a **right-hand direction,** limiting the serving distance radially to a maximum of 150 ft from distribution source, while the second service riser shall meet the same requirements but will serve in a **left-hand direction.**

It will be noted that the maximum radial distance from distribution source is 150 ft to the right plus 150 ft to the left, or a total of 300 ft of trailer lots to be served by one power company aerial drop. This is the key to the plan by which a power company service drop may be brought to a point of attachment (distribution center) every 300 lin ft.

Sizing Trailer Station Taps

When the sizing of conductors has been established by diagram chart and proper associated conduit determined, a means must be provided for the trailer station serving conductor attachment or tap to the underground serving conductor feeders. This is accomplished by the insertion of a junction box in the conduit runs as they emerge from ground level at each trailer station location. The placement of this box shall not be lower than one foot from grade level, with measurements taken from bottom edge of the box.

Junction boxes shall comply with NEMA specifications (raintight) or equal. Minimum stock size of approximately 10 in. wide, 8 in. high and 6 in. deep generally meet working requirements.

Gasketed threaded hub shall always be installed on the top surface for the conduit riser serving the trailer station meter or meters. This riser to the meter socket shall be a minimum of one inch, with three No. 6 conductors inserted, if trailer station serves one trailer and a minimum of 1¼-in. conduit, with three No. 4 RH conductors inserted if

trailer station serves two trailers. **(Important: It is recommended that underground serving feeders be run continuously through junction boxes without being cut and that connectors be used to tap the smaller wire inside these boxes.)**

Conduits entering the bottom face of the junction box need not have attached threaded hubs, providing that double locknuts are used along with a metal bushing that has an insulating insert. Such a bushing must provide means for equipment grounding (or bonding) to the case of the junction box. Equipment grounding (or bonding) of conduits is of great importance, as conduits get out of alignment after installation. This is caused by ground settlement or accidentally being bumped, loosening the bond.

Individual Trailer Metering

All meter sockets are set at exactly six feet from grade level to the center of the socket. Single socket or dual two-gang sockets may be installed to suit application.

Trailer chart was designed for one and two trailers per serving station. More than two trailers per station is frowned upon, as such grouping requires certain trailers of such a group to be served by cords exceeding the standard 25-ft extension cord. The extra-long cords needed to serve them cross over the ground in undesirable locations. Thus, making a limit of two trailers per station eliminates these undesirable features.

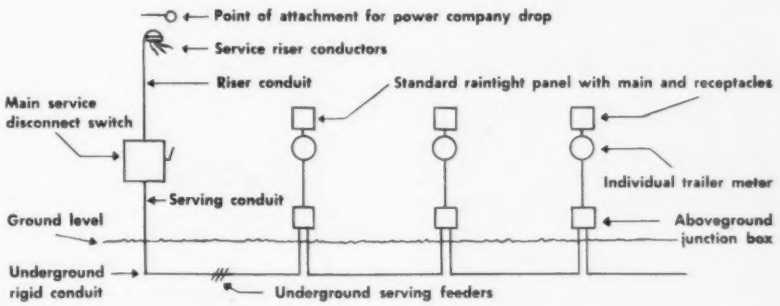
Individual Trailer Station Service Termination

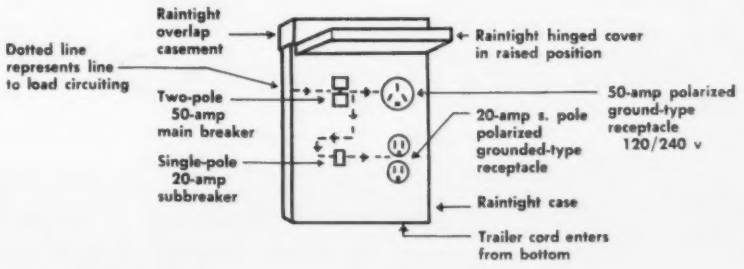
The design application for individual service center termination (service main disconnect means) can be accomplished by several satisfactory methods. The main object is that such a method meet code requirements: such as raintight service equipment, case bonding, service grounding, use of grounding-type receptacles and provisions for trailer cord strain relief at the service center. Several mobile home manufacturers of electrical service equipment have specifically designed raintight service panels with built-in service disconnect means associated with grounded-type receptacle trailer plug-ins. The minimum service breaker serves a 50-amp grounded-type receptacle, a 20-amp breaker subfeeding through the 50-amp service main, for the purpose of serving a 20-amp grounded-type receptacle.

PLAN	TRAILER FORMATION	NO. TRAILERS ON UG FEEDER	SIZE RHW FEEDER	SIZE FEEDER SWITCH	WIDTH TRAILER LOTS	FEEDER DIAGRAM
A	SINGLE ROW	1	4	60	25	
B	SR	2	2	100	25	
C	SR	3	2	100	25	
D	SR	4	2	100	25	
E	SR	5	2	100	25	
F	SR	6	2	100	25	PROBLEM NO. 1
A	DOUBLE ROW	2	2	100	25	
B	DR	4	2	100	25	
C	DR	6	2	100	25	
D	DR	8	2	200	25	
E	DR	10	0	200	25	
F	DR	12	00	200	25	PROBLEM NO. 2

A	SINGLE ROW	1	4	60	30	
B	SR	2	2	100	30	
C	SR	3	2	100	30	
D	SR	4	2	100	30	
E	SR	5	2	100	30	
A	DOUBLE ROW	2	2	100	30	
B	DR	4	2	100	30	
C	DR	6	2	100	30	
D	DR	8	1	200	30	
E	DR	10	00	200	30	

A	SINGLE ROW	1	4	60	35	
B	SR	2	2	100	35	
C	SR	3	2	100	35	
D	SR	4	2	100	35	
A	DOUBLE ROW	2	2	100	35	
B	DR	4	2	100	35	
C	DR	6	2	100	35	
D	DR	8	2	200	35	




Raintight overlap casement
Raintight hinged cover in raised position
Dotted line represents line to load circuiting
Two-pole 50-amp main breaker
50-amp polarized ground-type receptacle 120/240 v
20-amp s. pole polarized grounded-type receptacle
Single-pole 20-amp subbreaker
Raintight case
Trailer cord enters from bottom

The method of placement in relation to the meter socket is the option of the electrical contractor.

The accompanying formulas are for those interested in knowing how the figures entered in the columns of the chart have been derived.

Individual Trailer Average Load Calculations

	Watts
Average trailer (45x10 ft) = 450 sq ft 450 x 3 w per sq ft = 1,350 w, general lights	1,350
1 circuit small kitchen appliance load = 1,500 w	1,500
@ 100% demand	2,850
1 1,000-w hot water heater	1,000
1 ½-hp refrigeration air conditioner	1,127
Total	4,977

4,977 w, basically 5,000 w, per single trailer. Use 5,000 w per trailer in calculations.

To arrive at an average dimension for a livable, permanent trailer, which is the general type becoming commonly used in the better trailer parks, it was found that the 6-ft-wide trailers are now becoming obsolete. In their place, 8-, 10- and 12-ft-wide trailers are becoming common practice. The trailer lengths start at 40 ft and generally the de luxe jobs are longer, including those of 55 ft in length. Therefore, an average conservative width can be calculated at 10 ft wide and a conservative length at 45 ft, giving a total square footage of 450. Many de luxe jobs are now exceeding 500 sq ft.

The 450 sq ft are now multiplied by the standard 3 w per sq ft, the same as for residential occupancies on permanent foundations. This totals 1,350 w and of course is known as the general lighting load. This figure now enters the far right hand column. To this column we insert a 1,500-w kitchen small appliance circuit. Being very conservative, we use but one circuit, whereas occupancies on foundations are calculated for two. The 1,350-w general lighting plus the 1,500-w kitchen small appliance calculation now tallies 2,850 w. Being less than 3,000 w, the demand load automatically becomes 100%.

The next step is to include the anticipated loads. As common practice, electrical appliances are generally preferred to Butane gas, due to the simplicity, economy and safety factors, and are so generally accepted by the trailer owners. These loads are anticipated to be 1,000 w for one electric hot water heater and one ½-hp or ½-ton refrigeration room-type air conditioning unit. Such a unit would calculate at 1,350 w. It operates for long periods of time. It may be noted that many trailers use the ¾-hp or ¾-ton units, but for conservative calculations we used the smaller unit. The demand calculation on these two units is taken at 100% feeder demand as the number of units involved is less than four. The 1,350-w general lighting, along with 1,000-w hot water heater calculation and 1,127-w air conditioner tallies to 4,977 w. This is so close to 5,000, an even number, we now use 5,000 w as a basic figure. In calculations to determine the future load at each trailer location for the loading of the underground feeders, a demand factor credit is allowed. In doing so a special formula has been set up that takes into consideration the width of trailer lots, the distance of the feeder length and percentage voltage drop maintained at the most distant load from the distribution source.

Diagram Chart Wire Sizing Information

The following single-row and double-row formulas are shown for those who are interested in knowing how the wire calculations entered in Col. 4 of the diagram chart have been made.

Trailer Park Problem No. 1

What minimum size RHW underground serving feeders shall supply six trailers that are set side by side, in single-row formation on 25-ft-width lots?

Trailers to be served by RHW underground serving feeders, limited to a measured radial distance not to exceed 150 ft from distribution source to the farthest trailer station. (Use method F of diagram —25-ft lots.)

Single-Row Formation (Step by Step Formula)

Step 1— $\dfrac{\text{(\# trailer spaces) X (average width of lots in feet)}}{\text{2 (represents midpoint of feeder calculation)}}$ = **Midpoint calculation in feet**

Note: Use this figure in Step 3 calculation

Step 2— $\dfrac{\text{(5,000 w per trailer) X (\# trailers) X (75\% demand factor)}}{\text{240 v (represents working voltage of 120/240, 3-wire system)}}$ = **Adjusted amp demand load**

Step 3—Final calculations by standard d-c voltage-drop table

$$\frac{\text{(Midpoint distance both ways)} \times \text{(Ohms per cir mil-ft)} \times \text{(Adjusted amp load)}}{\text{(240 working voltage 3-wire system @ 120/240 1-phase)} \times \text{(1\% voltage-drop allowance)}} = \text{Cir mil of copper conductor required}$$

Above formulas with step-by-step figures entered

Step 1— $\dfrac{6 \times 25}{2} = \dfrac{150}{2} = 75$ = **Distance in feet at midpoint of feeder**

Step 2— $\dfrac{5{,}000 \times 6 \times .75}{240} = \dfrac{22{,}500}{240} = 94$ = **Adjusted amp demand load**

Step 3— $\dfrac{(75 + 75) \times 10.7 \times 94}{240 \times .01} = \dfrac{150{,}870}{2.4} = 62{,}862$ = **Cir mil of copper required for underground feeder**

Step 4—Comparison of cir-mil cross sectional areas of three conductor sizes

52,640 cir mil = No. 3 Comment—too small
66,370 cir mil = No. 2 Correct size to use for underground feeders
83,690 cir mil = No. 1 Comment—oversize

Basic rule: Underground serving conductors shall in no case be less than No. 2 RHW

Formula: Service Riser (RHW) Conductor Sizing

Step 5— $\dfrac{\text{(5,000 w per trailer) X (\# trailers served by riser conductors) X (75\% demand factor)}}{\text{240-v working voltage of 1-phase 120/240 3-wire system}}$

Above Formula With Figures Entered

$\dfrac{5{,}000 \times 6 \times .75}{240} = \dfrac{22{,}500}{240} = 94$ = **Minimum amp of copper required for service riser and in no case shall the conductor size be less than No. 2 RHW**

No. 2 RHW

Trailer Park Problem No. 2

What minimum size RHW underground serving feeders shall supply to a total of 12 trailers that are set side by side, in double-row formation set on 25-ft-wide lots?

Step 1— $\dfrac{(12 \times 25) \div 2}{2} = \dfrac{300 \div 2}{2} = \dfrac{150}{2} = 75$ = **Distance in feet at midpoint of feeder**

Step 2— $\dfrac{5{,}000 \times 12 \times .75}{240} = \dfrac{45{,}000}{240} = 188$ = **Adjusted amp demand load**

Step 3— $\dfrac{(75 + 75) \times 10.7 \times 188}{240 \times .01} = \dfrac{301{,}740}{2.4} = 12{,}573$ = **Cir mil of copper required for underground feeder**

Step 4—Comparison of cir mil cross sectional areas of three conductor sizes

105,500 cir mil = No. 0 Comment—too small
133,100 cir mil = No. 00 Correct size to use for underground feeders
167,800 cir mil = No. 000 Comment—oversize

Step 5—Using formula above for service riser conductor (RHW) size gives 188 amp, for 3/0 RHW

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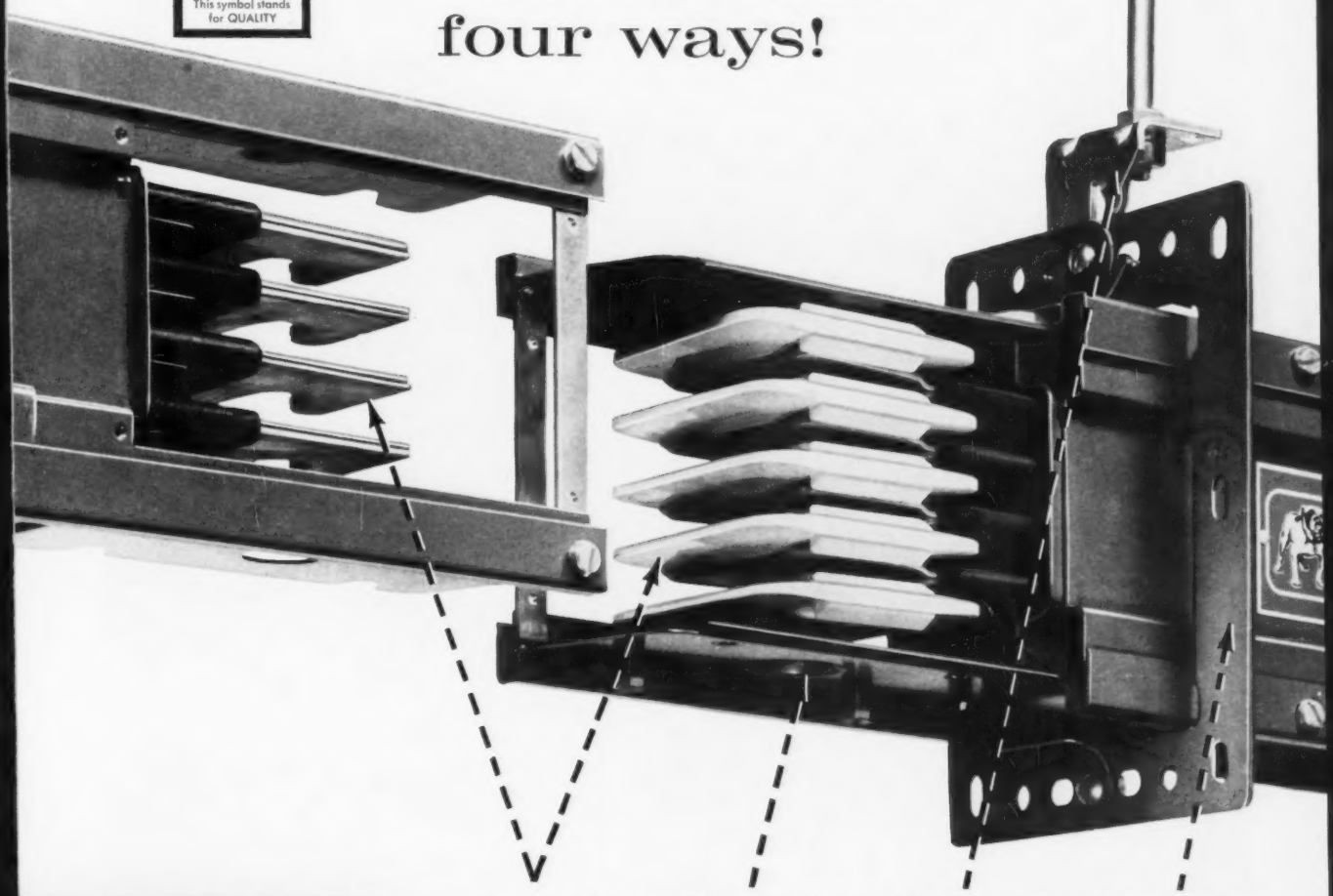

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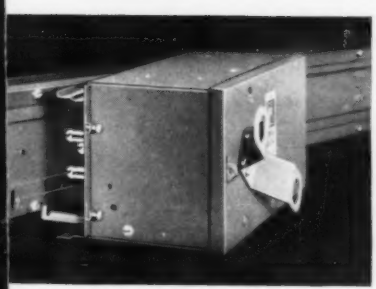

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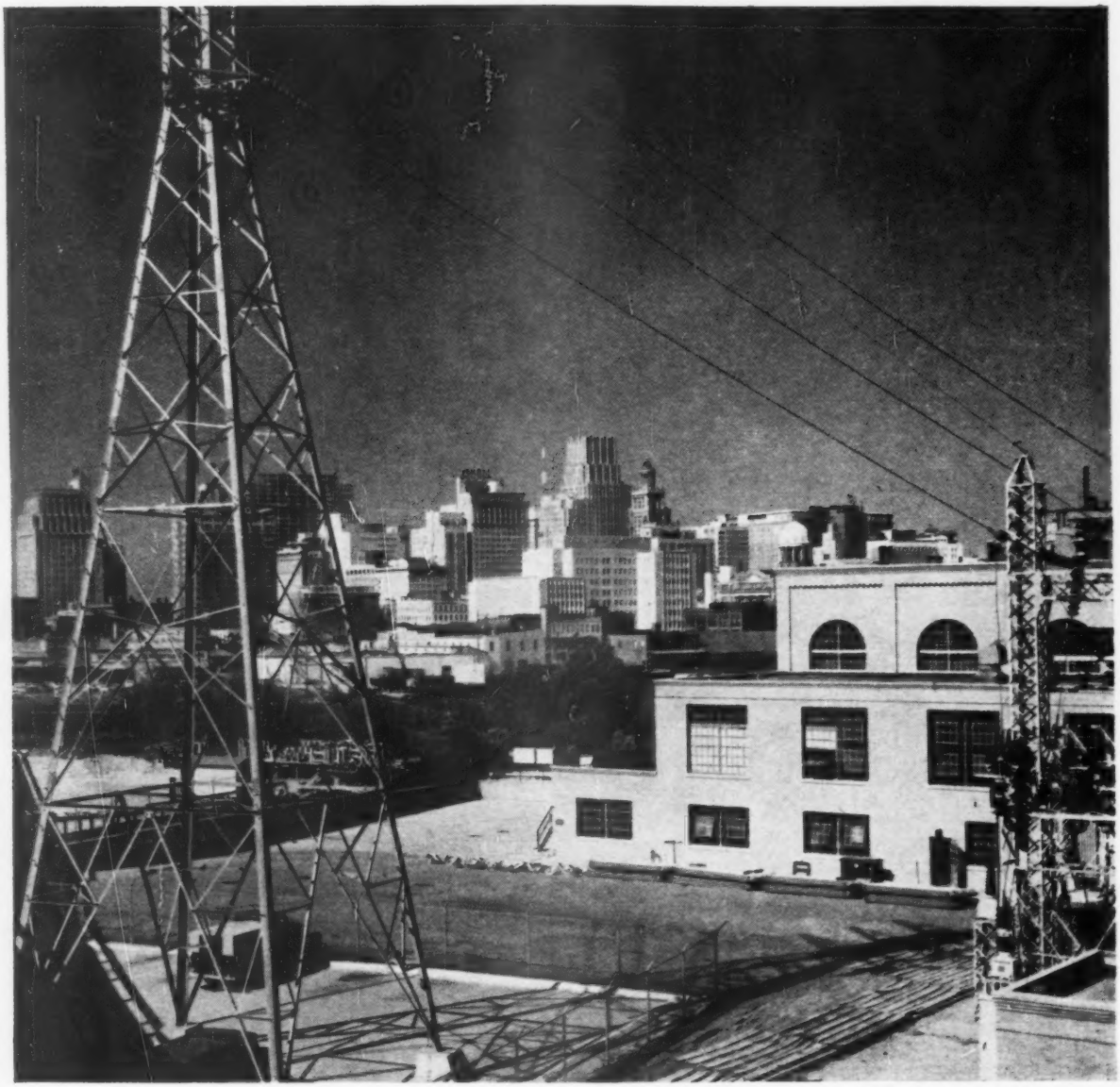

Deep in the Heart

Dynamic, vibrant Houston, deep in the heart of the Texas Gulf Coast, is the South's largest city and sixth largest in the nation. Capital of the Republic of Texas little more than a century ago, it is now regarded by many as the U. S. petrochemical and petroleum capital. Surrounded by natural resources, it is also hub of the Southwest's industrial marketing, rice milling, cotton trading and processing.

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Test Your Knowledge

Here are 24 points to test your specification know-how in the grey area of—shall I use switchgear or control? Score: 23-24, expert; 19-22, professional; below 19, turn the page and read the answers by H. A. Wright, supervisory engineer, control department, Allis-Chalmers Mfg. Co.

As a rule of thumb, control equipment is installed at the point of power utilization, whereas switchgear is used to govern power distribution and to protect the power supply system. Yet, there remains a certain amount of confusion when high-voltage contactors are referred to as "breakers," and specifications are written for industrial control based on switchgear standards. To illustrate basic external differences, photo above, left, shows an industrial high-voltage control center for motors up to 2,500 hp, while photo above, right, shows metal-clad switchgear being used for motor control.

Check your understanding of basic differences by noting which of the following statements are true and which are false. Detailed answers follow the questions.

	True	False
1. There are several exceptions to the 5,000-v limitation of industrial control.	____	____
2. High -voltage industrial control has several horsepower limitations in its applications.	____	____
3. There are no exceptions to the kva limitation on interrupting capacity in industrial control.	____	____
4. For highly repetitive service, industrial control is recommended.	____	____
5. If line capacity is greater than 50,000 kva, current limiting fuses must be used with industrial control.	____	____
6. Switchgear is also used to control motors on 2.5- and 5-kv systems.	____	____
7. "Blow off" refers to the parting of contacts under stress of high current.	____	____
8. Even a properly selected fuse may blow on starting current.	____	____
9. Current-limiting effect is the same for all size fuses.	____	____
10. System kva and voltage are the only details that require checking.	____	____
11. There is only slight difference in the mechanical arrangement of breakers in switchgear units and contactors in industrial controllers.	____	____
12. Switchgear does not utilize disconnect switches.	____	____
13. The terms "draw out" is now used in connection with industrial control. This arrangement, like switchgear, provides disconnect means when the contactor is removed.	____	____
14. Connections differ for auxiliary devices used in switchgear and control.	____	____
15. There are various differences between control and switchgear bus arrangements.	____	____
16. Switchgear requires insulated buses.	____	____
17. There are no major differences in instrumentation and relays in the two types of equipment.	____	____
18. Switchgear protects as well as governs the power system. Industrial control also protects as well as governs motors.	____	____
19. Switchgear should be applied where frequent starting and stopping is not encountered.	____	____
20. It is more common to misapply oil-immersed control equipment than air.	____	____
21. Explosionproof control is available in this voltage class—2,300-4,600 v.	____	____
22. Switchgear and control may be installed in the same lineup.	____	____
23. There is no difference in list price between switchgear and control.	____	____
24. One type of equipment should be chosen first, control or switchgear, before writing specifications.	____	____

1. *There are several exceptions to the 5,000-v limitation of industrial control.*

False. Above 5,000 v, switchgear should be used. For example, all 6,600-v motors should be controlled by switchgear.

2. *High-voltage industrial control has several horsepower limitations in its applications.*

True. Industrial control has the following horsepower limitations:

Voltage	HP at Unity Pf	HP at 80% Pf
2,300	1,750	1,500
4,600	3,000	2,500

Induction motor controllers have the same limitations as 80% power factor synchronous motor controllers. Switchgear, on the other hand, has no limitation except that imposed by the circuit breaker—3,000 amp at 5 or 13.8 kv.

3. *There are no exceptions to the kva limitation on interrupting capacity in industrial control.*

True.

4. *For highly repetitive service, industrial control is recommended.*

True. To explain, it is necessary to go back to the basic difference between contactors used in industrial control and circuit breakers used in switchgear. A contactor is both closed and held closed by means of a magnet. A circuit breaker, on the other hand, may be operated by means of a magnet but is held closed by means of a mechanical latch. Because of the mechanical complications of the latching mechanism, the circuit breaker is not normally used to control motors which are started or stopped frequently.

5. *If line capacity is greater than 50,000 kva, current limiting fuses must be used with industrial control.*

True. Control engineers say that if the capacity of the line is greater than 50,000 kva, current-limiting fuses should be used.

Backup breakers are considered fast if of the three- to five-cycle variety and are normally set somewhat longer. When using backup breakers, in conjunction with industrial control, there is a zone from the time the contactor drops (4½ cycles) to the time that the backup breakers open (8 to 20 cycles) that the contactor arcs severely, since it cannot interrupt current over its rating. Therefore, high capacity, high-speed fuses were developed to provide the protection that cannot be provided by circuit breakers. These fuses are designed to blow in less than one-half cycle.

6. *Switchgear is also used to control motors on 2.5- and 5-kv systems.*

True. Switchgear provides for the control of squirrel cage, synchronous and wound rotor motors on 2.5- and 5-kv systems and must be used to control motors on higher voltage systems, i.e., 6.6 to 13.8 kv.

7. *"Blow off" refers to the parting of contacts under stress of high current.*

True. The force on the contacts caused by a short circuit may be sufficient to overcome the contact spring pressure, causing the contacts to part.

8. *Even a properly selected fuse may blow on starting current.*

False. Fuses are obtainable in a number of different sizes. The fuse is selected from motor data covering full-load current and maximum inrush current. The energy dissipated by the fuse is based on I^2R. Therefore, a fuse curve plotted as time in seconds to current in amperes will follow a square curve—inverse time characteristic. If the fuse is properly selected, it will not blow on starting.

9. *Current-limiting effect is the same for all size fuses.*

False. The larger the fuse rating, the less current-limiting effect.

10. *System kva and voltage are the only characteristics that require checking.*

False. In addition to the kva rating, the maximum rms asymmetrical current available from the power system should not exceed 60,000 amp for industrial control or 80,000 amp for switchgear.

11. *There is only slight difference in the mechanical arrangements of breakers in the switchgear units and contactors in industrial controllers.*

True and False. (A trick question) The circuit breakers used in switchgear are removable. They are of two types: vertical lift or horizontal drawout. By means of a rack mechanism, the breaker may be unplugged (disconnected) and drawn out of the cubicle on its own wheels.

The high-voltage oil contactors used in industrial control are also "drawout" (see answer No. 13).

12. *Switchgear does not utilize disconnect switches.*

True. In switchgear, the primary finger arrangement serves as a disconnect means. Newest high-voltage control utilizes drawout arrangement eliminating the disconnect switch.

13. *The term "draw out" is now used in connection with industrial control. This arrangement, like switchgear, provides disconnect means.*

True. The latest design of high voltage motor control has a horizontal drawout contactor carriage. The high-voltage air contactor is mounted on wheels as the basic unit, to which is added the current limiting fuses, plug-in devices and high-voltage control panel.

14. *Connections differ for other auxiliary devices used in switchgear and control.*

True. The potential and control transformers used in switchgear are mounted on carriages and arranged to plug-in within a separate compartment. In industrial control they are stationary. Also, most relays as used in switchgear are of the plug-in type, while industrial control relays are not.

15. *There are various differences between control and switchgear bus arrangements.*

True. Switchgear uses insulated bus, while control does not. The current carrying capacity of the bus for switchgear is normally 1,200, 2,000 or 3,000 amp; for industrial control, 1,000 to 2,000 amp. Industrial control uses 5,000-v cable to connect the contactor to the main bus. Switchgear uses bus-work throughout. Both, however, meet the same dielectric test: 45 kv for a 2.5-kv bus, or 60 kv for a 5-kv bus.

16. *Switchgear requires insulated buses.*

True. As mentioned earlier, switchgear is designed for continuous service on distribution lines. Here continuity and protection of the system are of prime importance. The user is willing to pay more for this insurance. A bus fault in a substation may shut down an entire area, whereas a bus fault in a lineup of industrial controllers would affect only a few motors in one plant.

17. *There are no major differences in instrumentation and relays in the two types of equipment.*

False. Generally speaking, industrial control uses the same type and quality of instruments used on switchgear. The relays, on the other hand, are normally more rugged and less pleasing to the eye.

18. *Switchgear protects as well as governs the power system. Industrial control also protects as well as governs motors.*

True. Industrial control provides thermal overload protection on two phases as standard, with an optional addition for the third overload relay. Short-circuit protection is provided by means of fuses or by means of a main switching device (line contactor) having an interrupting capacity up to 50,000 kva. Switchgear, on the other hand, provides both thermal overload and short-circuit protection by means of the switching device and overcurrent relays.

19. *Switchgear should be applied where frequent starting and stopping is not encountered.*

True. A typical application might be a base-load pumping unit on a transcontinental pipe line, with a pump that operates 24 hours a day, day in and day out. Here the motor should be controlled by switchgear, since the breaker or latch device is more desirable for continuous service.

On this transcontinental system there might be a feeder line with a pump operated by means of a float switch on a collecting tank. Assuming that the pumping unit starts and stops frequently, industrial control should be used because a contactor is more suitable for repetitive operation than a circuit breaker.

20. *It is more common to misapply oil-immersed control equipment than air.*

True. There is one rather outstanding misapplication — using oil-immersed equipment for jogging duty. Contacts under oil erode more rapidly than contactors in air. Another misapplication is the use of a circuit breaker as backup protection for high-voltage industrial control.

21. *Explosionproof control is available in this voltage class — 2,300-4,600 v.*

False. There is no Underwriters' approved equipment available in the 2,300- or 4,600-v class. However, a type of industrial control equipment is available that is as safe as is economically feasible to build.

22. *Switchgear and control may be installed in the same lineup.*

True. Such an arrangement is quite common. The feeder connects to an interrupter switch which is throat-connected to the transformer. The transformer secondary, in turn, is throat-connected to the distribution switchgear, and a bus transition unit is provided between the gear and the high-voltage motor controllers. The switchgear and control line-up is matched in appearance.

23. *There is no difference in list price between switchgear and control.*

False. The price of industrial control is lower than switchgear.

24. *One type of control should be chosen first, control or switchgear, before writing specifications.*

True. When specifying control equipment, it is important to choose the type of control first (either industrial control or switchgear), based on manufacturer's published information and on industry standards, and then write the specification based on that type of control. In other words, do not mix nomenclature in the specification.

Summing up, metal-clad switchgear ratings are 2.5 to 13.8 kv and 75- to 1,000-mva interrupting capacity. This class of switchgear comprises all indoor and outdoor cubicle-type construction, consisting of metal-enclosed units and auxiliary compartments characterized by the following:

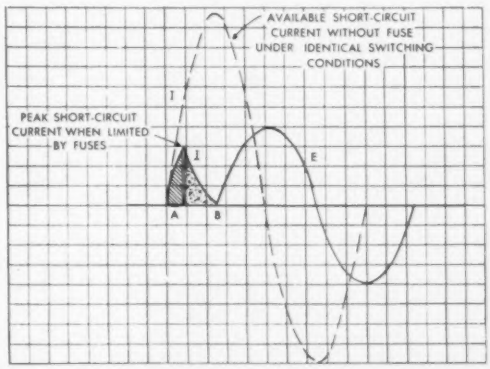
1. All parts are completely enclosed within grounded metal enclosures.
2. Secondary control devices and their wiring are isolated from high voltage primary devices by grounded metal barriers.
3. Major parts of the primary circuit, such as circuit breakers, transformers and buses, are isolated by grounded metal barriers.
4. The circuit breakers are removable and are equipped with self-coupling primary and secondary disconnecting mechanisms. These mechanisms allow the breaker to be moved either horizontally or vertically to the connected or disconnected positions.
5. Interlocks are provided to insure safe operation.
6. Buses, connections and joints are insulated throughout.

Industrial control, according to NEMA, covers electric, magnetic, mechanical or electronic devices which govern in some predetermined manner the electric power delivered to its connected apparatus.

High voltage industrial control equipment is limited to:

1. The use of oil or air circuit breakers (in this case, circuit breakers referred to in standards are generally contactors) with interrupting ratings of 50,000 kva or less and for service voltages up to 5 kv.
2. A combination of properly coordinated fuses and contactors where interrupting capacity requirements do not exceed 150,000 kva at service voltages not exceeding 2,500 v or where interrupting capacity does not exceed 250,000 kva at service voltages greater than 2,500 and not exceeding 5 kv. Fuses with high interrupting speed are used in modern industrial control.

To check your knowledge regarding optimum application at some future date, keep this checklist handy as a ready reference. It might come in handy.



High interrupting speed of current-limiting fuses prevents short-circuit current from building up to the full system short-circuit capacity. Fuses are shown in the top of roll-out contactor below. These devices are intended to function on commercial voltages of 750 v or less, d-c, and 5,000 v or less a-c. Curves at left are plotted to show current as a function of time in cycles

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At some point in his operation, should a contractor consider . .

MOBILE RADIO

What about mobile radio? What will it do for the electrical contractor? What will it cost him? At what point in his operation will it become most economical? These are the questions that most contractors come to at one time or another in their operation.

One contractor utilizes his radio system to dispatch his delivery trucks from job to job and to the supply houses to pick up needed material. His drivers are given a few instructions at the beginning of the day, then radioed the remainder of their day's work.

Through the use of radio, this company figures that it saves time and reduces mileage on its vehicles, thereby saving on gasoline cost and repairs. Time is saved because the driver is never making *back-tracks* to the office or to a point from which he can telephone.

Another large contractor says, "On widespread housing or construction projects, distances between crews of one or two miles are quite common. On such a job, high-speed communications are vital if the job is to be finished within the specified contract time. Several times every day, field supervisors must be reached to supply answers to important problems to prevent costly down time.

Cost

In discussing cost, consider the case of the contractor who has a suitable location for his base station. That is, no remote charges for putting the transmitter on the top of a hill or the like. Say he has one base station and five mobile stations in his trucks.

The installed cost for such a radio system would be about $4,000. If it is our desire to finance the whole project and let it pay for itself out of savings, what does this mean if we choose an ultra conservative life expectancy of five years and an interest rate of 7%?

Monthly amortization charge on $4,000 @ 7%	$ 80
Monthly maintenance charge	50
Total monthly cost	$130

Five vehicles should work a minimum of 100 days a month, giving a radio cost of $1.30 per vehicle per day. With direct labor going at $3.55 to $4.65 per hour in the 11 Western states, it appears that a saving of one-third of a man-hour per day or less for each vehicle will just about pay for this two-way system.

Buy or Lease

Most manufacturers of radio equipment will also offer to lease the equipment. How does the contractor fare under this arrangement? If we consider the same system consisting of one base station and five mobiles, we find:

Equipment cost	$3,600
Installation cost	400
Total	$4,000

A $400 initial rental cost and the $400 installation cost must be paid in cash to the manufacturer. In this discussion assume it will be borrowed from the bank at the assumed rate of 7% over a period of five years—the usual lease length.

Monthly amortization charge on $800 @ 7%	$ 16
Monthly lease payment on $3,200 balance	67
Monthly maintenance charge	50
Total monthly cost	$133

At the end of this period it would then cost approximately $500 to purchase the equipment outright from the manufacturer. So, from these sample calculations it appears that outright purchase is more economical than leasing if the cost of money is around 7%.

These are some of the reasons for using two-way radio. Each contractor must, of course, decide for himself. With more mobile stations, the cost per vehicle will go down as each mobile station will bear a percentage of the base station cost. With smaller systems, it may be that one of the principals in the business can supervise more jobs and make his influence felt over a wider area, thus keeping his crews more efficient. Whatever his reason, it appears that the possibilities of mobile radio should be investigated by each contractor, regardless of his size.

When equipment and material must be sent to job sites to keep projects from bogging down, or when the need arises to contact key personnel, two-way radio can often pay for its annual cost in one day. Licensing and instruction of operating personnel is not difficult

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Motors and Controls—XVIII

NOW COME THERMAL-MAGNETICS

TOM HUGHES, CALIFORNIA DIVISION OF INDUSTRIAL SAFETY

In last month's installment, we were considering the magnetic overload relay. Its advantages — that it has no critical alloy and that ambient temperatures have no considerable effect on its operation — were mentioned.

This last advantage is altered, however, when we attach a dashpot to the armature. To understand the factors involved we should define a dashpot. The term was adopted from the use on the valve stops of the famous (but now extinct) Corliss steam engine. To obtain quick "cut-off" the valve linkage was dropped on each stroke and the dashpot cushioned the drop. The dashpot on our magnetic relay is really more similar to pneumatic doorstops but they didn't have such doorstops when the relay was developed.

In the dashpot relay the armature and plunger of the dashpot are mounted on a threaded hollow spindle. Vertical rise of this spindle trips the relay at the prescribed point of travel. The pull of the armature can be gaged by screwing it up and down this threaded spindle and thus in and out of the magnetic field. The travel of the spindle can be restrained or relaxed by regulating a needle valve, which allows the oil to pass from above the plunger (piston) down through the hollow shaft to fill the void created by the upward movement of the armature.

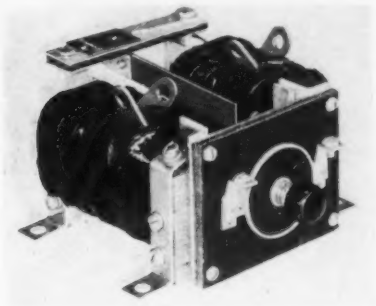
You can see how nicely the speed of upward movement can be regulated by either the degree of pull on the armature or restraint of the dashpot; and the limit of travel (before tripping) can be regulated by the portion of armature that is positioned in the strongest portion of the coil flux. This dashpot relay is noted for its inverse-time factor and accurate adjustment.

We can see that there is no thermal memory or other compounding of stimuli in the operation of this relay. On the first start of a motor it moves up to a certain level and then gradually settles back as the starting current falls off to running current. If the motor is shut off the armature settles clear back to its initial position. The thermal relay can't do this. It takes time for its components to lose their heat of the first start and the heat of another start is just compounded on top of the existing heat in the tripping element. Thermal memory is a weak point of thermal relays regardless of how they are heated or "ambient corrected."

However, as we started to show, the ambient temperature can alter the characteristic of the dashpot oil. Some manufacturers use silicon oils whose viscosity is less affected by temperature. Of course, the sales engineer will point out that, when the surrounding cold slows the rise of the armature toward tripping, it also slows the rise of injurious temperatures in the motor at the same time. One manufacturer has gone to great lengths to produce oils for different climates and operating characteristics and can prescribe from several oils according to the known conditions.

In application of these relays the dashpot is used for motors starting heavy loads where a longer time limit is desired. They can be applied to frequently started motors if the motor is correctly chosen for its load. The instantaneous is used almost entirely where there is danger of jamming in machinery or overrunning the limits of travel. It is applied where normal starting current is greatly reduced by one means or another and there will be no nuisance tripping.

Of course, the weak point of these relays is their lack of response to thermal mistreatment of the motor they are protecting. For this reason, some application engineers team them up with a thermal unit in series with them for use on an ordi-



Adjustable trip thermal-magnetic relay

nary motor as an added safeguard.

Another adaptive trick is to shunt the magnetic relay out of the circuit while starting a motor in which starting current is no problem, or one which is starting a high inertia load. In their use with the old manually operated compensator starters they were shunted in the starting position.

There is one more important overload relay to be considered. It combines features of both major classes we have discussed. It is the Westinghouse MG and is covered here to complete the coverage of noncoordinated protective relays.

It consists of two small transformers mounted on one frame and magnetic core. The secondaries of these transformers are fixed coils, permanently (electrically) loaded by conducting bimetallic heaters. These heaters are deformed by their own heat and serve to trip the control circuit. The primary coils of the transformers are the changeable elements; graduated in capacity to suit the different motors.

There are two distinct advantages of this relay over the others. The most important is that its two sections work on a sort of "push-pull" balance or opposed setup. Thus, if a short in one portion of a motor winding or "single phasing" causes considerable unbalance in currents flowing through the two transformer primaries, the relay will trip much faster than on normal overload duty.

Another advantage results from the use of transformer exchange: the current carrying coil (primary of transformer), being separated from the section that does the tripping, can be of a more rugged design. It is therefore designed to carry more than twice as much fault current without damage as is the normal thermal or magnetic relay. This is a distinct advantage where it is used under the machine tool rule, which permits a group of motors to be fed through one branch circuit disconnect and short circuit overcurrent protection.

This MG relay has an adjustment in the form of a pointer, for varying the trip setting of the thermal elements. The range of variance is from 15% below to 15% above the neutral setting. The manufacturer says that this is an ambient compensating feature and rates the neutral setting of the pointer at 40 C ambient. This, however, will depend on whether this relay is mounted in an enclosure or on a panel. The same applies to the mounting or surrounding circumstances of any thermal relay.

This relay can have another tripping device added and the manufacturer then designates it as MGI. Since the small laminated core serving the two transformers is designed to effectively handle the flux produced by the primary (when it is properly chosen for and handling the current associated with the particular motor it protects) any abnormal increase in current will saturate the core.

When you saturate the core of any inductor you are going to build up a stray field of "leakage flux." The MGI has an added tripping element that responds only to this stray field. Thus, you see, in the normal operation of this relay this special tripping device is just sitting there and does not even know what is going on. But, let any abnormal current send a fly over the outfield fence and it is waiting there to catch it.

This might therefore be applied in the same way as the instantaneous—trip magnetic: to machines where overtravel or inherent jamming hazard requires quick response of motor protection. On the other hand, the normal instantaneous-trip magnetic must be applied to a motor whose winding characteristics prevent it from overheating while this MGI relay provides the thermal protection for normal running-current also.

In the ordinary MG relay, the manufacturer can provide a special set of cores for the transformers, which provides a different saturation curve. This will adapt it for use with motors starting high inertia loads.

Thus we see that motor application engineers have a bewildering assortment of running-current protectors with many adaptors and graduating adjusters to play with. But in the best of families nuisance tripping is still to be found and we still say they are working on the wrong end of the problem: where frequent starting or strange loads are involved.

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PRODUCT INFORMATION SERVICE

For fast action in securing the manufacturers' literature listed below simply circle and mail the postpaid card opposite. Use the same card to obtain more information about the new products described on the following pages. This Electrical West service is intended as an aid in keeping product files current

(11) SPACER CABLE SYSTEM—A 12-page booklet entitled The Anaconda Spanway Spacer Cable System is available from this company. CIRCLE item 11.

(12) TRANSFORMERS—For more information regarding design details for the Allis-Chalmers 65 C rise transformers, CIRCLE item 12.

(13) ALUMINUM TOWERS—Alcoa offers additional information on the structural design and fabrication of aluminum towers and substation structures. CIRCLE item 13.

(14) ATOMIC REACTORS—Atomics International, Division of North American Aviation, offers information on the 75,000-kw sodium graphite reactor built for Consumers Public Power District at Hallam, Nev. CIRCLE item 14.

(15) PRESSURE CONNECTORS—Buchanan Electrical Products Corp.'s bulletin W-1 described its splice caps for wire sizes Nos. 2 through 18. CIRCLE item 15.

(16) ALL-ALUMINUM CLAMPS—Jasper Blackburn's bulletin No. 6003 describes the all-weather protection available in its clamps. CIRCLE item 16.

(17) CABLE CONTROL—Carol Cable Co.'s booklet gives full details on its Carol Protected-Profits Inventory Control Plan. CIRCLE item 17.

(18) ONE-TIME FUSE—The Chase-Shawmut Co., a subsidiary of I-T-E Circuit Breaker Co., describes its new one-time fuse in bulletin O-T 601. CIRCLE item 18.

(19) PULLING COMPOUND — Electro Compound Co. offers descriptive literature on its wire-pulling lubricant for lead, rubber or other synthetic-covered cables. CIRCLE item 19.

(21) PEAKING PLANT — Electro-Motive Division of the General Motors Corp. offers complete information on its diesel peaking plant. Units are available in increments of 2,000 kw up to a total of 10,000 kw. CIRCLE item 21.

(22) TOOL HANDBOOK—Graybar Electric Co. has a fully illustrated handbook with information and suggestions on the best way to use and preserve the basic hand tools used in the utilities trade. CIRCLE item 22.

(23) CONDUIT STRAP—Victor Specialties Inc. offers its new strap catalog, listing more than 600 items to fasten wire, cable, tubing and conduit. CIRCLE item 23.

(24) POWER CONNECTORS — Gibbons Electric Co. has a new catalog listing its complete line of power connectors and bus fittings. CIRCLE item 24.

(25) SWITCHGEAR — Bulletin 2800-2B furnishes you with complete details on I-T-E Circuit Breaker Co.'s new 13.8-kv switchgear. CIRCLE item 25.

(26) TOOL GUIDE—Mathias Klein & Sons invites your request for a copy of the new Klein Pocket Tool Guide. CIRCLE item 26.

(27) POST INSULATORS—New Lapp catalog 8 tells the full story about line posts and station post insulators. CIRCLE item 27.

(28) BULLWHEEL TENSIONER—Petersen Engineering invites your inquiry on converting your reel dolly into a bullwheel tensioner in its bulletin No. 34. CIRCLE item 28.

(29) INDUSTRIAL LIGHTING — Pacific Gas and Electric Co. has made available a new booklet, What's New in Well-Planned Industrial Lighting. CIRCLE item 29.

(31) ELECTRICAL METALLIC TUBING —Republic Steel Corp. has a booklet if you wish to learn about the installation of its Electrunite EMT. CIRCLE item 31.

(32) FITTINGS—The Series 800 interlocked armor cable fittings introduced by G&W Electric Specialty Co. is described in catalog H. CIRCLE item 32.

(33) DUCT—New literature on Soapstone's Oct-O-Duct and a pamphlet on its recently introduced LaceStone are available. CIRCLE item 33.

(34) ACCESSORIES—A new line of accessories for types RE and WE reclosers is described in Line Material Bulletin CRICE. CIRCLE item 34.

(35) LEASE PLAN—A lease plan for lighting equipment is described in Westinghouse booklet SA-8865. CIRCLE item 35.

(36) HANGERS—Steel City describes adjustable bar hangers, designed for quick installation in dry wall board and plaster construction, in bulletin BH-5. CIRCLE item 36.

(37) COMPOUND — Technical data and test information on Contax, a sealing and oxide inhibiting compound, is contained in bulletin No. 6009; released by Jasper Blackburn Corp. CIRCLE item 37.

(38) ELECTRIC HEATING—A presentation of its products and a discussion of electric heating applications is given in a brochure prepared by Lennox Industries. CIRCLE item 38.

(39) CLAMPS—A 76-page manual, published by TA Mfg. Co., lists materials and specifications, gives recommended applications and latest techniques for mounting tubing, wiring and similar hardware. It also includes a description of the company's line of clamps, brackets and supports. CIRCLE item 39.

(41) FITTINGS—Information on its new line of compression fittings is available in a bulletin from Anderson Electric Corp. CIRCLE item 41.

(42) CAPACITOR—John E. Fast & Co., lists its complete line of capacitors in a new bulletin, No. F-92-2. CIRCLE item 42.

(43) SEALING—Duxseal, an all-purpose sealing and calking compound for industrial and electrical applications is described by Johns-Manville in brochure IN-318A. CIRCLE item 43.

(44) RACEWAYS — For electrical contractors, engineers and architects a new catalog published by Wheatland Electric Products gives specifications for Headerduct cellular floor feeder raceways. CIRCLE item 44.

(45) INSULATION — Irvington brand PTFE insulating materials are described in a new folder. It is available from Department WO-389, Irvington Division, Minnesota Mining & Mfg. Co. CIRCLE item 45.

(46) SIGNALS—A 60-page signaling equipment catalog, bulletin S-100, has been issued by Edwards Co. and may be secured through distributors or from the manufacturer. CIRCLE item 46.

(47) BUS DUCT — Application data for electric utility bus duct is contained in bulletin, No. 30-664, offered by Westinghouse Electric Corp. CIRCLE item 47.

(48) DEVICES—Wadsworth Electric Mfg. Co. has issued a new guide to help in selection of service equipment in fusible and circuit breaker devices. CIRCLE item 48.

(49) FITTINGS—Technical data and test information on aluminum heavy-duty multibolt fittings are contained in folder 6003 published by Jasper Blackburn Corp. CIRCLE item 49.

(51) RECORDING SYSTEMS — A technical bulletin on its Tele-Scan recording systems for transmitting data to distant computer facilities via standard telephone circuits is offered by Daystrom's Control Systems Division. CIRCLE item 51.

(52) PLUG-IN BUS DUCT — Application data for plug-in bus ducts are contained in a 28-page booklet published by Westinghouse Electric Corp. as No. 30-661. CIRCLE item 52.

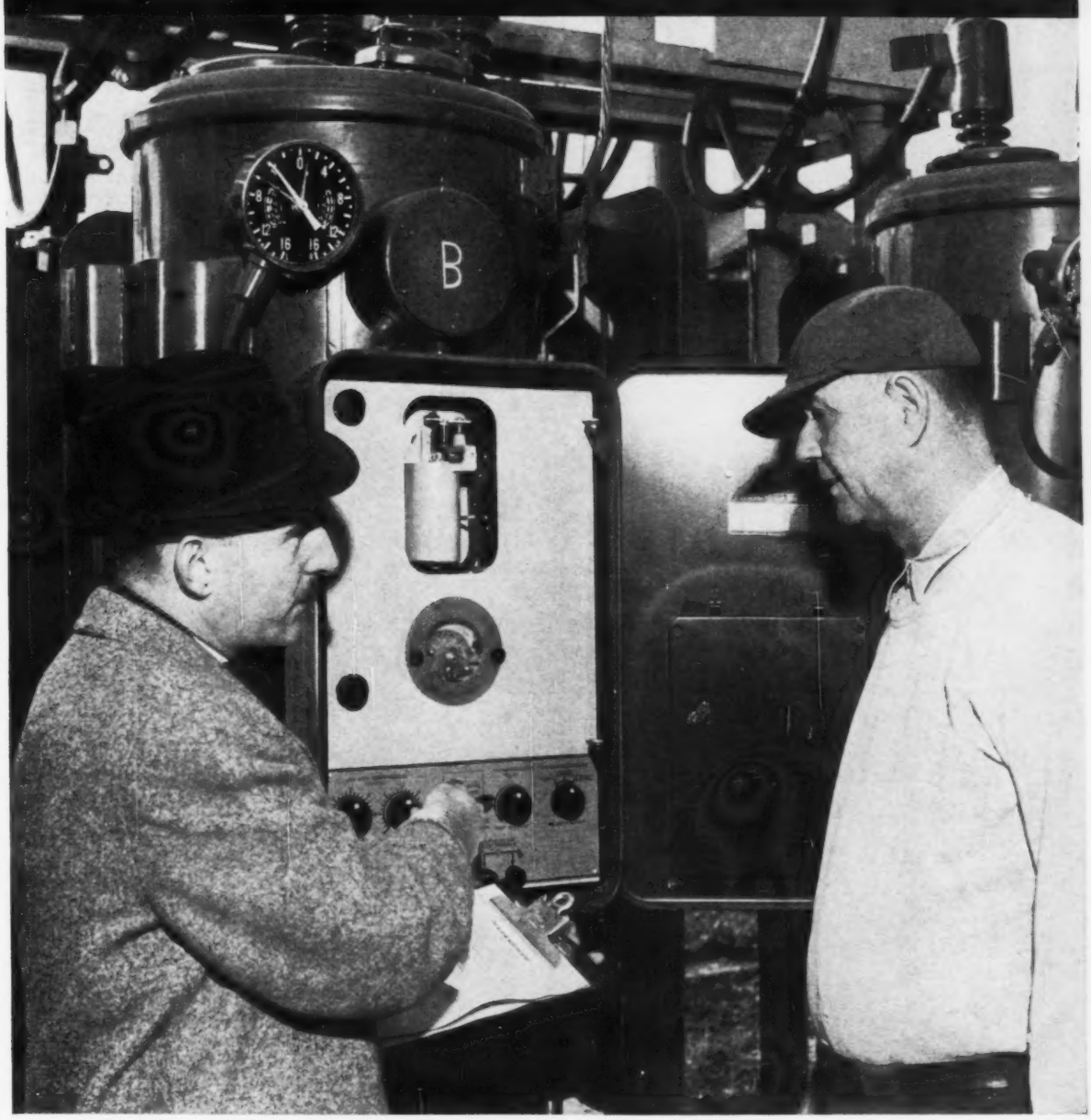
(53) PAINT — Skyco heat-resisting aluminum paint for chain-link fence is described in a new bulletin from the Skybryte Co. CIRCLE item 53.

(54) PANELBOARDS—A new line of distribution panelboards with enclosed magnetic starters is described in GEA-6728 available from General Electric's Distribution Assemblies Department. CIRCLE item 54.

(55) TRUCK BATTERIES — Type Thirty batteries for motive power use in industrial trucks are covered in a 24-page brochure published by Gould-National Batteries. CIRCLE item 55.

(56) DRY-TYPE TRANSFORMERS — Small, light, quiet dry-type transformers in ratings 3 through 50 kva, single phase, 600 v and below are described in a bulletin released by Allis-Chalmers Mfg. Co., for bulletin 61B8222B. CIRCLE item 56.

ANOTHER STEP AHEAD IN VOLTAGE REGULATION



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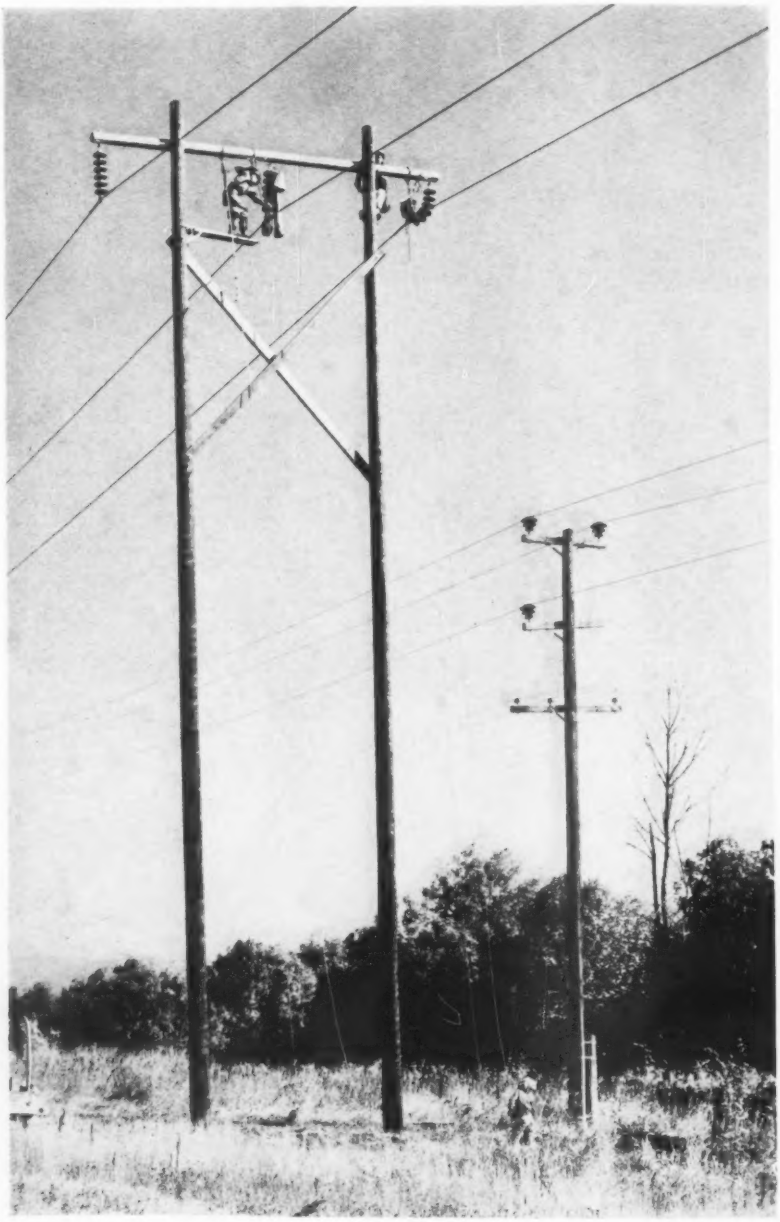
PRODUCT NEWS

New Designs and Applications



Aluminum Crossarm

(57) *Aluminum Co. of America, 1501 Alcoa Bldg., Pittsburgh 19, Pa.*

Portland General Electric Co. has used tubular aluminum crossarms for H-frame structures on its recently completed St. Helens to Burlington, Ore., 115-kv transmission line. A total of 98 towers with aluminum arms, comprising about 11.5 miles of the line's 16-mile length, has been installed. Fabricated by Aluminum Co. of America, the arms were selected for the new line as result of performance of tubular aluminum crossarms on an earlier 230-kv line. Line shown employs 25-ft aluminum arms mounted on 75-ft wood poles.

Light Meter

(58) *Pyramid Instrument Corp., 630 Merrick Road, Lynbrook, L. I., N. Y.*

A low-cost meter called the Liteprobe is a basic element in the "Action Plan Kit" Graybar Electric is furnishing to electrical contractors with necessary information and materials to promote profitable modernization relighting in older buildings and outdoor spaces. Essentially, the Liteprobe is a foot-candle meter with a rotary scale having five different lighting-level indications, which the contractor may use in determining the amount of lighting necessary to bring a given installation up to acceptable standards.

FM Radio Filter

(59) *Collins Radio Co., P. O. Box 1891, Dallas 21, Tex.*

Operators of two-way FM mobile radio equipment can comply with the FCC split-channel ruling and maintain peak receiver performance with a new mechanical filter now available from Collins. With this new filter, operators can quickly and easily modify their receivers to match systems using the ±5-kc transmitter deviation specified under FCC narrow-band technical standards. Designated the F455YA-120, the new filter has a 455-kc center frequency and a passband of 12 kc. Its sharp cut-off characteristics help keep interference from adjacent channels to a minimum.

Aluminum-Coated Wire

(61) *National Standard Co., Niles, Mich.*

A new aluminum-coated steel wire has been developed by National Standard Co. called Alstan. The manufacturer reports that a solid phase bond is established between the aluminum and steel, which permits drawing and fabricating. Alstan has been produced with an aluminum coating of 20 to 60% of total cross-sectional area. This gives electrical conductivity of 20 to 40% of equivalent sizes of copper wire.

Aluminum Switch Base

(62) *Reynolds Metals Co., Richmond 18, Va.*

Electric air break switch bases now can be made less expensively, lighter and more rigid by using aluminum, according to this company's product development division, where bases were designed to be incorporated into I-T-E Circuit Breaker Co.'s standard 115-kv air break switch line. Reynolds is presently developing a complete series of bases for all outdoor disconnecting switches from 7.5 kv to 340 kv.

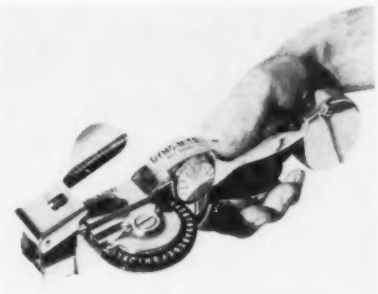
Ambient Compensated Overload

(63) *Arrow-Hart & Hegeman Electric Co., 103 Hawthorn St., Hartford 6, Conn.*

The development of a compact overload relay that compensates for both heat and cold, operating on the same time curve at all temperatures from —20 F to 165 F, is announced by the Arrow-Hart company. The compensation is said to be completely automatic with no field adjustment necessary.

READER SERVICE CARD

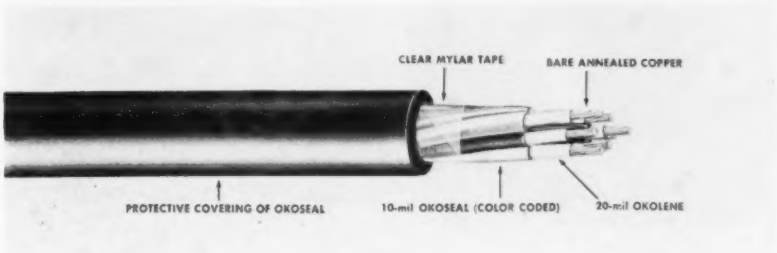
For your added convenience in obtaining more information on the new products shown on these pages or offered by our advertisers elsewhere in the issue, a postage-paid reader service card has been included between pages 72 and 73. Just circle the numbers corresponding to the items described and tear out and mail the card.



Labeling Tool

(65) *Dymo Corp., 2546 10th St., Berkeley 10, Calif.*

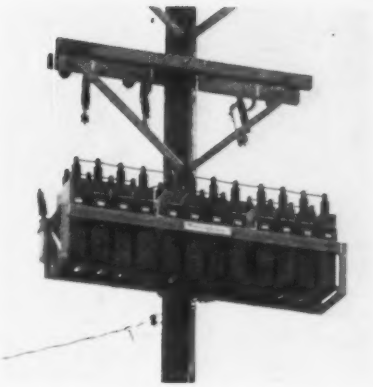
The Dymo Corp. announces an addition to its line of labeling tools—the de luxe Dymo-Mite model M-3. This machine features a chrome-plated lightweight aluminum body and a built-in corner rounding and hole punch device. The new M-3 will emboss Dymo's complete line of tapes, both pressure-sensitive colored plastic and metals.



Control Cable

(64) *Okonite Co., Passaic, N. J.*

The Okonite Co., subsidiary of Kennecott Copper Corp., introduces a new small-diameter plastic control cable—Okonite P-30. The manufacturer says it is a low cost general purpose control cable for utilities and industries and is suitable for all types of installations — conduit, aerial, duct, tray, direct burial, in wet or dry locations.

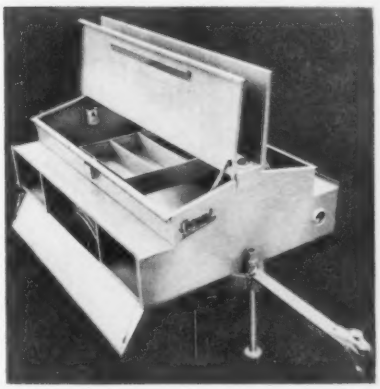


Small Capacitors

(66) *Westinghouse Electric Corp., Pittsburgh 30, Pa.*

Westinghouse announces a new capacitor design enabling a utility to double its pole-top kvar capacity.

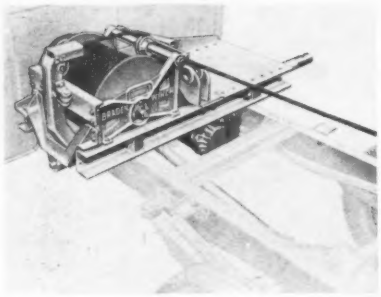
The new smaller unit permits utilities to hang 1,200 kvar on a pole top using the same pole space previously occupied by a 600-kvar bank. The units come assembled and wired, ready for installation and are available in clusters and in-line arrangements, according to the manufacturer.



Tool Trailer

(67) *Aeroil Products Co. Inc., 69 Wesley St., South Hackensack, N. J.*

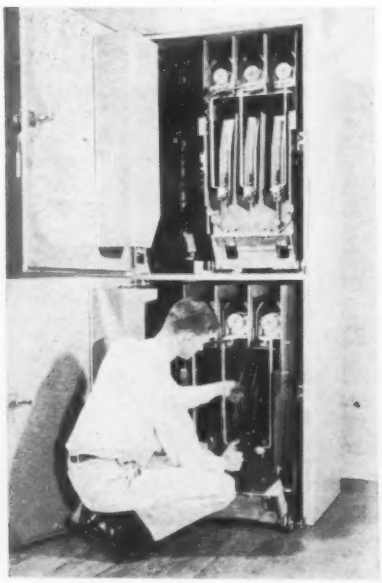
This company announces its new line of tool trailers available in 4-, 5-, 6- and 8-ft models, featuring strong lightweight waterproof compartmented construction with drop leg for parking. The de luxe trailer features sliding tray, full length work shelves, cylinder locks and blinker lights, according to the manufacturer of this equipment.



Winch

(68) *Braden Winch, Division of Nautec Corp., Broken Arrow, Okla.*

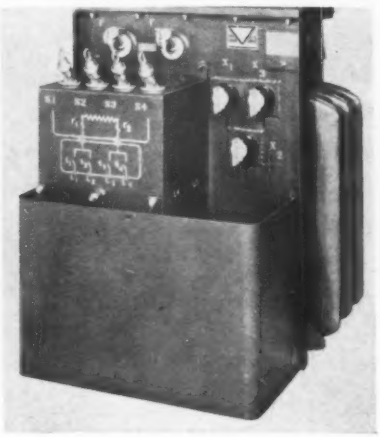
A new winch, model CL, developed by the Braden Winch Division, has been designed to meet the special needs of utilities. The winch combines constant load, constant speed, constant horsepower with safe, efficient one-man operation. The winch has a new cable-handling system that separates the power and storage functions of the winch, with two power drums doing the pulling with a large capacity storage drum to take up the cable.



High-Voltage Control

(69) *Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.*

This company's newly marketed Space-Maker unit is said to be one-half the size of previous models, yet with the same rating and capacity as its predecessors. Some of the features introduced in this new controller include a two-high design for space saving and drawout contactors. The design is said to be possible because of a compact new air contactor that gives significant operating benefits.



Transformer

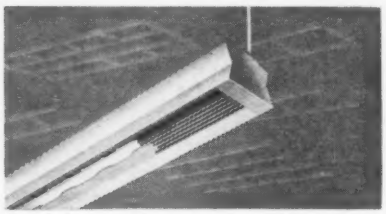
(71) *R T & E Corp.,* 1900 *E. North St., Waukesha, Wis.*

Referred to by RT&E as the Saf-TT-Front Terra-Tran, this manufacturer of ground level distribution transformers announces a new design, which is said to guard utility personnel from accidental contact with high-voltage connections by encasing all primary voltage within a shielded and grounded compartment.

Bump Cap

(72) *E. D. Bullard Co.,* 2680 *Bridgeway, Sausalito, Calif.*

A new, lightweight head protection has been introduced by this company and is known as the Bullard Bump Cap. The cap is said to be ideal for workers in close quarters where scalp lacerations and minor concussions are commonly incurred. The caps are made of impact-resistant plastic material, in white and yellow, and will not crack, dent or shatter. The top lining and sweatband are made of foam rubber.



1,500-Ma Lighting Fixture

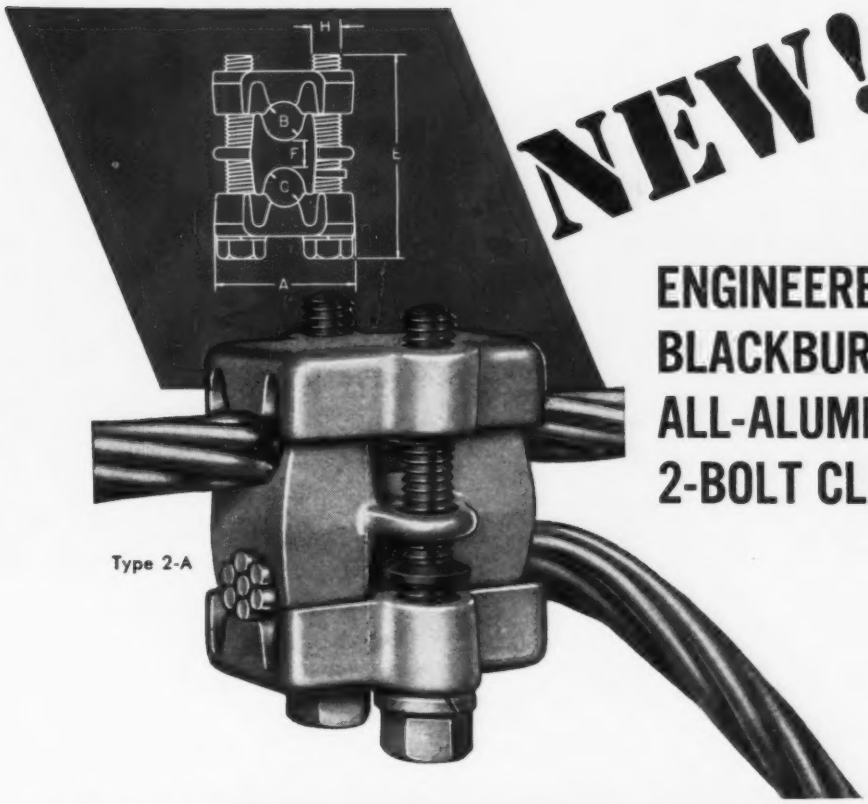
(73) *Smoot-Holman Co., P. O. Box* 4097, *Inglewood, Calif.*

The Smoot-Holman Co. has developed this new Perfect Vision ultra-high-output lighting fixture to accommodate the new 1,500-ma lamp, capable of producing up to 300 f-c of comfortable shadow-free light. It is said to be efficient and effective in the illumination of such areas as fine assembly, engineering offices or other areas where high lighting standards are desired.

Plastic Meter Cover

(74) *Busada Mfg. Co., Flushing, N. Y.*

This company announces the introduction of a transparent plastic meter cover which is said to be lighter, tougher and as clear as glass. It is said to have amazingly high impact strength, and to be lastingly resistant to outdoor weathering. The cover is available through Westinghouse Supply Co. or Graybar Electric Co.



Type 2-A

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ALL WEATHER PROTECTION

On Aluminum or Bi-Metallic Connections

Contact surfaces guarded by rainshield design of castings—inhibitor will not "wash out" even under driving wind and rain.

Condensation is drained off through ports in castings regardless of installation position—never allowed to accumulate around the conductors.

Designed with hot stick crews in mind.

Massive all-aluminum clamp—including hardware—may be used on aluminum or on copper conductors with inhibiting compound. Extra thick, highly conductive aluminum spacer separates dissimilar conductors for added corrosion protection.

Four clamps accommodate a wide range of wire sizes—main from 6 to 795 ACSR, tap from 8 to 397.5 ACSR. Write for samples and literature.

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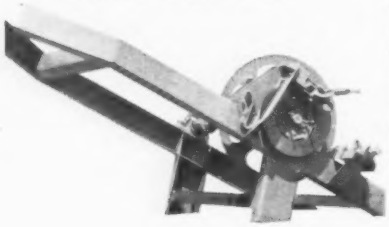
Now—Convert your own Reel Dolly to a Bullwheel Tensioner WITH A

PENGO 5000-U Assembly

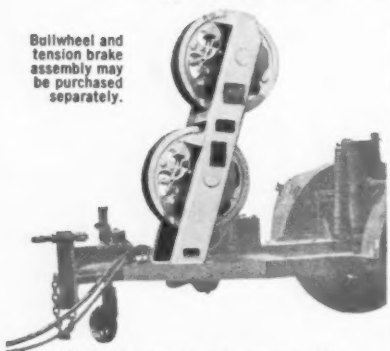
5000-U assembly installed by City of Medicine Hat, Alberta, Canada.

Here's an easy way to build up a modern bullwheel tensioner at low cost—simply install a PENGO 5000-U Bullwheel Assembly to your old trailer or reel dolly. You'll have a tensioner with Neoprene-lined 26" bullwheels, capable of handling practically any distribution line stringing job at tensions to 2,000 lbs. at up to 4 mph.



Support arms, reel spindle with reel brake, and hand rewind assembly. 2⅜" spindle will handle reels to 75" diameter, 44" width unless reduced to fit your trailer.

Bullwheel and tension brake assembly may be purchased separately.



We invite you to write or wire for literature, prices—please address Dept. 34

PETERSEN ENGINEERING COMPANY, INC.

Santa Clara, California

16 Phone: AXminster 6-7712

Manufacturers—Distributors

► I-T-E Circuit Breaker Co. has transferred **Dale G. Hebron** to its Los Angeles District office at 1921 E. Seventh St. He will serve contractor customers and will handle the company's complete product line. He was formerly field application engineer with I-T-E's BullDog Division at Cleveland and moved to the West Coast on Nov. 1. Los Angeles contractor sales for I-T-E are handled by **T. A. Saunders,** who has been in that area for the past year.

Hebron

► Officials of Westinghouse Electric Corp.'s Sunnyvale manufacturing division and of its largest union have signed a new **three-year contract providing an employee progress and security program.** Carl Sohm, president of District Lodge 93, International Association of Machinists (AFL-CIO), and Frank Gorham, business agent, signed the contract in behalf of 1,160 production and maintenance employees at the Sunnyvale plant. L. E. Hedrick, division manager, and L. D. Gibson, industrial relations manager, signed for the company. The Santa Clara County Council of Carpenters (AFL-CIO) and the Teamsters union, Local 296, at the plant have also ratified similar agreements.

► **Maddox Sales Co.,** Los Angeles, has added a tenth outside salesman to its organization. **Jim Peterson,** formerly with Incandescent Supply Co., San Jose, will work out of the Maddox San Francisco office. Along with Peterson's appointment, the firm has announced extended representation of two lines. It has taken over the Ilsco line of copper and aluminum plugs and connectors in northern California and is now handling Revere outdoor floodlighting equipment in Arizona. Maddox has had the Revere line in southern California for the past six years.

► **Westinghouse** has opened new repair facilities in Phoenix, at 1825 E. Jefferson St. The modernized plant now has 22,000 sq ft of repair and office space under one roof and adjacent outdoor work and storage area. **Joseph E. D. Morris** is manager of the repair plant.

► **Porta House** is opening a new branch office and service yard in Los Angeles, which it claims will make it possible to deliver and erect its prefabricated field offices and tool sheds in that area within 24 hours of receipt of order. The firm has its prefabricating and general office at 6767 Broadway Terrace, Oakland, Calif.

► **T. R. Van Wagoner Co.** is now **Fisher-Pierce** sales representative in Utah, southern Idaho and western Wyoming. Main office is at 1415 S. Main St., Salt Lake City.

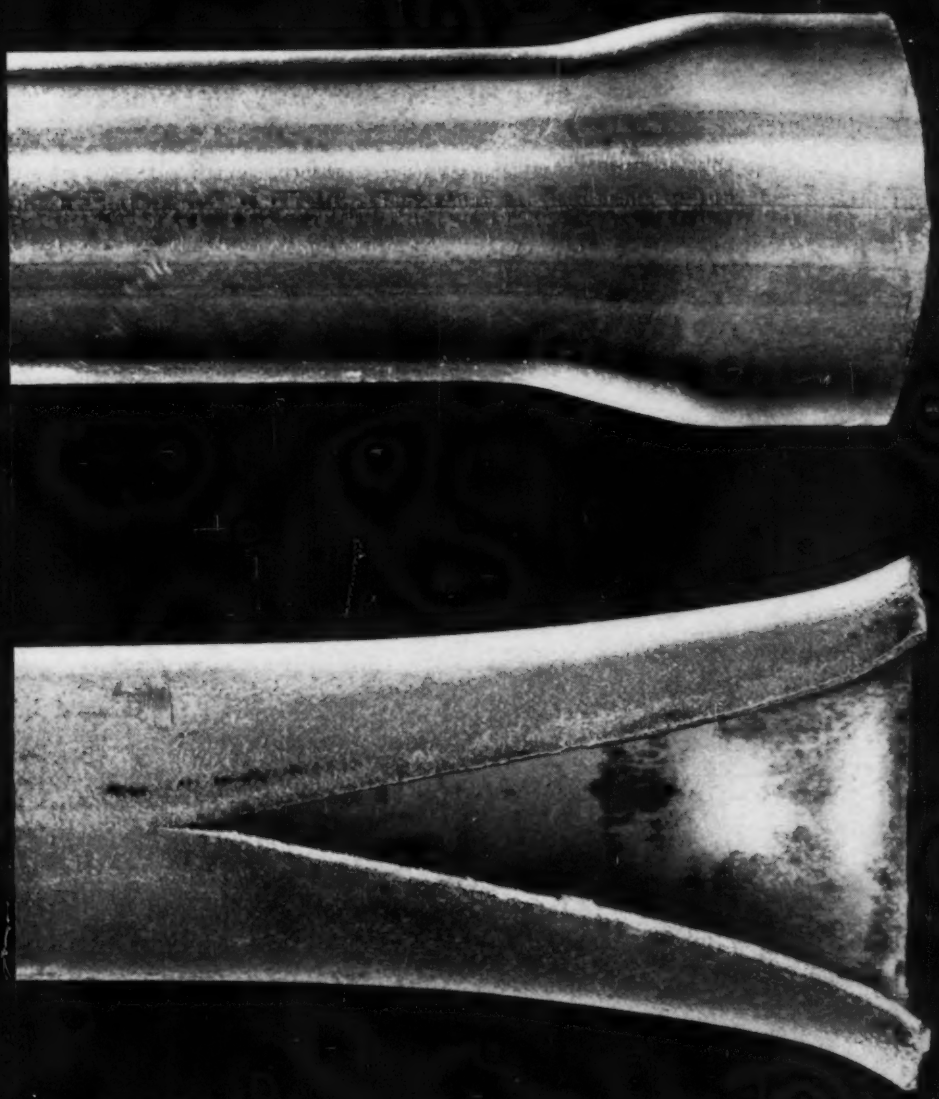
► **Mathias Klein & Sons** has appointed **Don Swanson** as its Pacific Northwest representative. Swanson's headquarters will be in San Francisco.

► **Graybar's** Central Pacific District announced appointment of **Ray P. Grosse** as district sales manager effective Dec. 15. He replaces **C. M. Newbill,** who has been transferred to Jacksonville, Fla., as manager. Grosse returns to the Bay area after a four-year absence, during which he has been manager of the El Paso branch and district sales manager for the Atlantic District. A native of Oakland, he started with the company there and was transferred to San Francisco headquarters in 1951 as manager of inside construction sales.

Grosse

► Our November announcement about Strohecker's Spokane office was a little garbled, according to **F. A. Strohecker.** Instead of setting up a new office in Spokane, as stated in the item, **C. V. Harris** is the new man in that territory, replacing **Elmer Johnston,** who has gone into semi-retirement after 15 years with the company.

► **Brundage Lighting Associates, Day-Brite** Lighting Co.'s San Francisco representative, has appointed **Leon P. O'Neill** as a sales representative. O'Neill will be located in San Jose, Calif., working in the area formerly covered by **James C. Ramsey.** O'Neill joined the Day-Brite organization in 1957.



Shown here unplated

CIRTUBE® EMT is the one on top

The other one is ordinary EMT that failed early in a pressure test. CIRTUBE EMT held up far beyond UL requirements. The reason: *continuous induction welding*, by far the best technique for making *bead-free, split-free* welds on high quality EMT.

The benefit: your men get easier, neater bending without kinking or flattening—and they get it right the first time around. Add easy fishing, a good-looking, life-time finish, easy-handling bundles and fast, friendly service—and you'll know why more and more contractors are specifying CIRTUBE EMT.

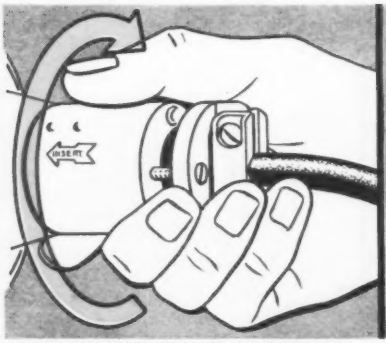
Ask for it on your next job—you'll like working with it.

CIRCLE WIRE & CABLE CORP.

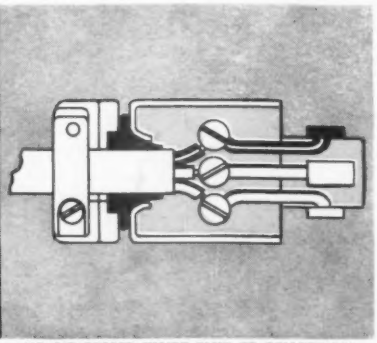
SUBSIDIARY OF **CERRO CORPORATION**

PLANTS: Maspeth and Hicksville, N. Y. **SALES OFFICES & WAREHOUSES:** In all principal cities.
Rubber Covered Wires & Cables • Varnished Cambric Cables • Plastic Insulated Cables • Neoprene Sheathed Cables • "CIRTUBE" EMT

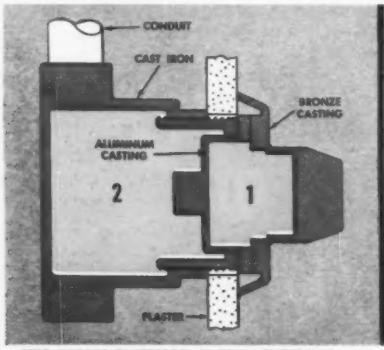
CIRTUBE EMT *Ask for it!*



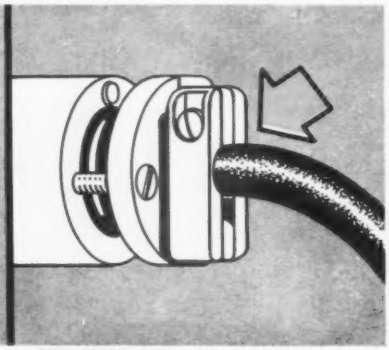
NO ARCING WHEN PLUGGING OR UNPLUGGING. Outlet is electrically "dead" until plug is inserted and rotated 22-25°. Reverse turn disconnects current before plug is removed. Spring pressure and keyed construction prevent accidental disconnection.



NO AIR SPACES INSIDE PLUG TO COLLECT GAS OR MOISTURE. After plug is wired to cord, electrician pours a self-hardening insulating resin into all air spaces. Interior of plug becomes solid, water-tight, vapor-tight mass.



TWO SAFETY CHAMBERS IN WALL OUTLET. Gas-tight chamber No. 1 (bronze and aluminum castings) contains and seals off switching mechanism. Cast iron chamber No. 2 keeps minor internal explosions from spreading to room.



CORD CANNOT PULL OUT OF PLUG. Double-clamping cord-grip relieves strain on plug terminals. And because terminals and wires are completely embedded in insulating resin, connections cannot loosen to cause arcing.

NEW

EXPLOSION-PROOF

RECEPTACLE AND PLUG

FOR CLASS I, GROUP C OR D, ATMOSPHERES

The Hubbellock Explosion-Proof Receptacle and Plug prevent arcing when electrical connections are made or broken in explosive atmospheres. No special wiring is required for installation in new or existing structures.

There are no air spaces in the plug where explosive gases can collect. No current can flow to the receptacle contacts while the plug is being inserted or removed. Switching takes place inside a vapor-sealed safety chamber of heavy bronze and aluminum castings.

Any 20-ampere, 125-volt, 60 cycle A.C. appliance may be operated from the receptacle by substituting the Hubbellock Explosion-Proof plug for the present plug. Appliances equipped with the Explosion-Proof plug will also operate in conventional 3-wire Hubbellock receptacles.

Plug and receptacle are listed by Underwriters' Laboratories and are described by the National Fire Protection Association for use in Class I, Group C or D, explosive atmospheres. They are ideal for hazardous industrial areas and for hospital operating and delivery rooms.

Write now for detailed specifications and prices.

"Hubbellock" is a registered trademark of Harvey Hubbell, Inc.

EXPLOSION PROOF *Hubbellock*® WIRING DEVICES

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Trading Post

Space in the Trading Post is available at $4 per line per issue with a minimum of three lines – more than seven lines – $18 per inch. Write to Trading Post, Electrical West, 255 California St., San Francisco 11, Calif.

Eastern manufacturer of quality baseboard and panel heaters wants qualified representatives in Seattle, Portland, San Francisco and Los Angeles. Must have good distributor contacts. Refer to Dept. MR101.

Manufacturer of electrical radiant heating system wants northern California representatives. Refer to Dept. MR102.

Experienced manufacturers' representative covering northern California and Nevada desires wire and cable account. Well known to top distributors. Refer to Dept. MR103.

Electric distribution products manufacturer wants Western regional sales manager. Must be aggressive and well known in electric utility and distributor organizations. Salary open. Refer to Dept. MR104.

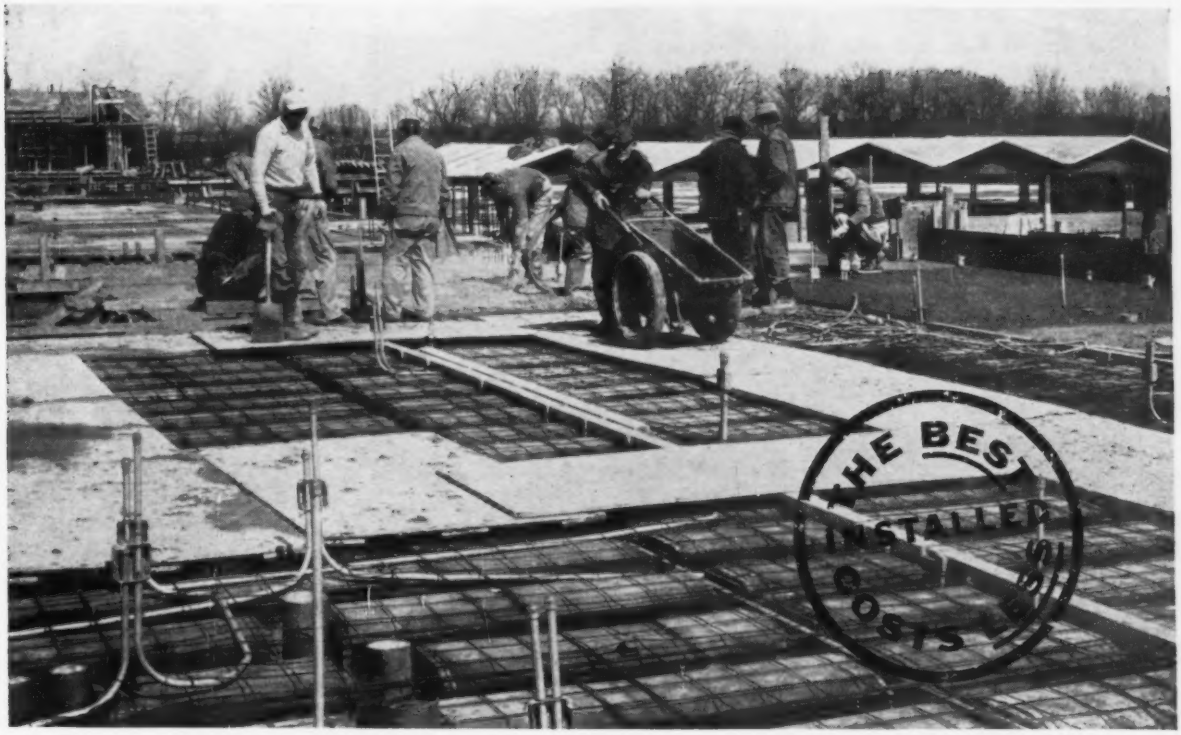
Retired sales executive available for part-time marketing consulting in the California area. Refer to Dept. MR105.

Southern California manufacturer of transmission line construction specialties wants representatives in the Pacific Northwest and Rocky Mountain areas. Refer to Dept. MR106.

Sales engineer, 38, with seven years' service for one of country's largest corporations wants opportunity in small aggressive company. Location must be in the West. Refer to Dept. MR107.

Overseas experience for sale. Seven years in Europe, Africa and India make me qualified to handle your export business. Sales records in each assignment. Refer to Dept. MR108.

Long-established manufacturers' representative organization with offices in northern and southern California is looking for recognized lines to round out distribution equipment package for electric utility customers. Warehouse facilities available. Refer to Dept. MR109.



Maryknoll Junior Seminary, St. Louis County, Missouri
Architects and Electrical Engineer: Leo Daly Co., St. Louis, Mo.
General Contractor: Gamble Construction Co., St. Louis, Mo.
Electrical Contractor: Kaemmerlen Electric Co., St. Louis, Mo.

St. Louis contractor praises

"Definite Savings" of Republic ELECTRUNITE E.M.T.

(ELECTRICAL METALLIC TUBING)

Kaemmerlen Electric Company used Republic ELECTRUNITE E.M.T. exclusively for all raceways in the new Maryknoll Junior Seminary in St. Louis County.

Mr. H. Chub Winkelmann, Contracting Department Manager, writes how pleased he is with the results. He reports definite savings because of "your numerous features such as INCH-MARKS, GUIDE-LINES, and easy pulling inside surfaces." Further, he likes the fact that "uniform bending produces a neat and good mechanical installation."

Check Winkelmann's findings yourself. Put ELECTRUNITE E.M.T. to work on your jobs. Exclusive features make installation easier, reduce wasted materials, and let you pocket a profit. Pick up enough bundles from your electrical distributor to run your own tests. You'll find that "The *Best* costs *Less* installed."

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I want to learn more about the installation savings of Republic ELECTRUNITE® E.M.T.

Name _____ Title _____

Firm _____

Address _____

City _____ Zone ____ State _____

LATE NEWS FLASHES

Continued from p 57

possibility of future residential distribution at higher voltages and the introduction of new dielectric materials, Karl S. Geiges, vice president, Underwriters' Laboratories Inc., Santa Clara, told the second AIEE Western Appliance Technical Conference on Nov. 7 in Los Angeles some of the problems facing the manufacturers in placing safer electrical equipment in the hands of the public.

Adequacy Promotion Pays Off

Although residential building in Vancouver, B. C., has been reported as down from previous years, the Electrical Service League reports that up to Oct. 15 in the metropolitan Vancouver area 2,887 homes were wired to Red Seal certification of adequacy and 162 received the Bronze Medallion, 16 the Gold Medallion.

1961 a Trade Show Year

Trade shows will be numerous in 1961, previous announcements indicate. Sacramento will make use of the California State Fair grounds for a California Spring Festival April 15-23 featuring, among other things, wiring and garden lighting. Also the Electrical Maintenance Engineers Assn. of Northern California will stage an Electrical Industry Show at Brooks Hall, San Francisco, April 5-9. Electrical contractor chapters and IBEW have agreed to participate in it, too. In Los Angeles there seems to be competition ahead. Its annual Construction Industry Exposition and Home Show scheduled for June 1-11 at the Memorial Sports Arena will be followed on Oct. 7-10 by a new Western Building Industries Exposition in the Great Western Exhibit Center off the Santa Ana Freeway. In Denver the Rocky Mountain Electrical Manufacturers' Representatives Club will stage an industry show at the Denver-Hilton convention center, Feb. 21-22. And there will be a show of electric motor shop equipment in connection with the National Industrial Service Assn. annual convention at the Jack Tar Hotel, San Francisco, June 11-14.

Tacoma Has New Code

Tacoma replaced its 12-year-old code with a new one based on the 1959 National Electrical Code, as of Jan. 1, according to Bert N. Hardy, chief electrical inspector. Among more significant changes are allowance of nonmetallic sheathed cable in one- and two-story commercial buildings with less than 5,000 sq ft area, outside of Fire Zones 1 and 2. Likewise cable can be used in single- and two-family dwellings and in multi-dwellings if not more than two stories high and if each apartment exits directly to the outside. New electric heating provisions include allowance of up to 4 kw on one thermostat but requires an individual thermostat for each room with fixed space heating. Branch circuits for heat are limited to 4 kw. Wall heaters larger than 1,650 w can have a maximum heating density of 500 w per sq ft. Baseboard heaters are allowed a density of 300 w per lin ft.

Seattle Tests Fluorescent Street Lights

Seattle, which only recently modernized its entire street light system, is making a test of fluorescent two-lamp street luminaires in a five-block section to compare their merits with the mercury units now used. Both the City Light and the traffic engineering department of the city are joining in the test to determine how well fluorescents hold up in light intensity and maintenance over a period of time. The two fluorescents per unit draw 255 w, and produce 13,800 lumens initially; the single mercury lamps draw 450 w including ballast and produce 20,000 lumens.

Here are the Graybar Offices in the West

ARIZONA

Phoenix:	1700 North 22nd Ave. ALpine 2-2371
Tucson:	212 South Park Ave. MAin 2-6439

CALIFORNIA

Bakersfield:	2828 "K" St. FAirview 4-4755
Fresno:	2626 Hamilton Ave. ADams 7-4175
Long Beach:	800 West 16th St. HEmlock 2-2911
Los Angeles:	210 Anderson St. ANgelus 3-7282
Oakland:	1911 Union St. GLencourt 1-5451
Oceanside:	805 N. Tremont St SAratoga 2-2141
Sacramento:	1900 - 14th St. HIckory 4-8830
San Bernardino:	655 South "H" St. TUrner 9-1051
San Diego:	720 State St. BElmont 3-1361
San Jose:	1376 N. Tenth St. CYpress 2-9090
San Francisco:	1750 Alameda St. MArket 1-5131
Santa Ana:	301 French St. KImberly 3-8309
Santa Barbara:	329 S. Salinas St. WOodland 5-1013
Van Nuys:	15520 Cabrito Road STate 2-9600

COLORADO

Colorado Springs:	630 West Vermijo Ave. MElrose 4-3701
Denver:	104 Wazee Market TAbor 5-7111

IDAHO

Boise:	1325 Idaho St. BOise 3-2594

MONTANA

Butte:	604 E. Aluminum St. BUtte 3233

OREGON

Eugene:	2380 West Broadway DIamond 4-2224
Portland:	N.E. 60th and Banfield ATlantic 8-5661

UTAH

Salt Lake City:	336 North Third West St. ELgin 9-8771

WASHINGTON

Seattle:	1919 Sixth Ave. South MUtual 2-0123
Spokane:	West 1033 Gardner Ave. FAirfax 7-6611
Tacoma:	2112 "A" St. MArket 7-0164

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You can save money with this booklet

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For your sample copy of LONG LIFE TO TOOLS, ask your Graybar salesman, or write us directly: our guess . . . once you've read LONG LIFE TO TOOLS, you may feel it's well worth passing along to everyone concerned . . . engineers, superintendents and even your line crews. Just let us know how many additional free copies we can send you for distribution. We'll supply them promptly.

Graybar, a working "partner" of utilities for years, knows utility tools and tool problems. But, whatever the problem, whether a special order, special product information, regular scheduling or emergency shipments of materials, equipment and tools, Graybar is geared to provide the Utilities with *special* assistance.

978

When Graybar is your auxiliary warehouse—

You save on storeroom costs
Reduce inventory investment
Insure prompt delivery
Step up manhour efficiency
Simplify bookkeeping

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ELECTRIC COMPANY, INC.

Everything Electrical GraybaR ELECTRIC COMPANY

IN OVER 130 PRINCIPAL CITIES

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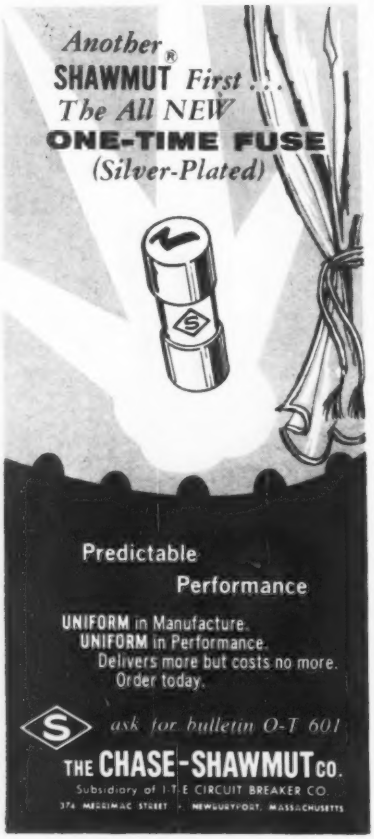
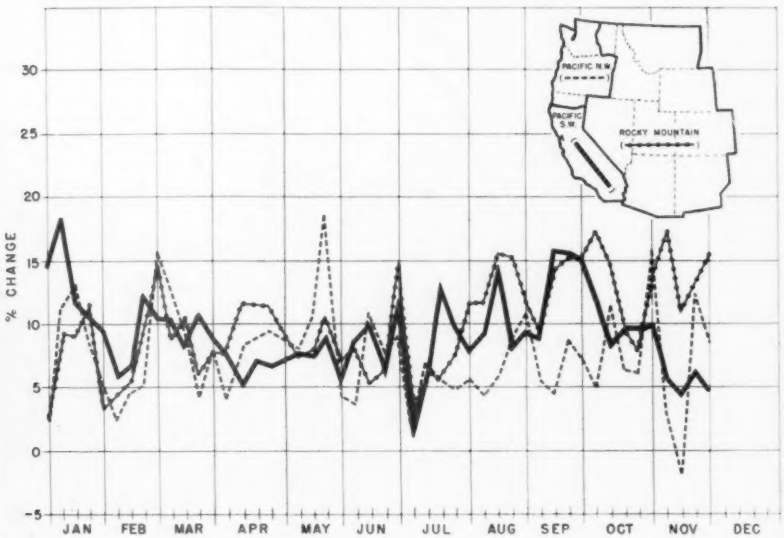


WESTERN BUSINESS TRENDS &

Output Comparisons

Year-to-Year Kwh Output Changes. Per Cent Change Over Same Week One Year Ago for Region as Indicated in Keyed Map



PLANS FOR CAPITAL SPENDING

(Billions of Dollars)

Industry	1959 Actual	1960 Estimated	1961 Planned	1960-61 % Change	1962 Planned
All manufacturing	$12.07	$14.33	$13.93	— 3	$13.35
Electrical machinery manufacturing	**.91**	**1.15**	**1.11**	**— 3**	**1.11**
Mining	.99	.99	.90	— 9	.89
Railroads	.92	1.04	.79	—24	.83
Other transportation and communications	4.69	5.20	4.61	—11	4.18
Electric and gas utilities	**5.67**	**5.89**	**6.14**	**— 4**	**6.01**
Commercial	8.21	8.61	8.70	— 1	8.54
All business	32.55	36.06	35.07	— 3	33.80

Relative Wholesale Prices of Electrical Material

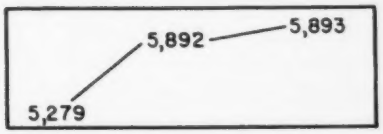
	Latest Month	Previous Month	Year Ago
Wire and cable	132.3	131.3	136.4
Watt-hour meters	120.9	120.9	120.9
10-hp motors	132.0	132.0	155.3
225-hp motors	208.8	202.8	203.9
Hydro generators	185.5	185.5	198.5
Steam generators	203.5	203.5	203.5
15-kva transformers	133.0	133.0	133.5
50-kva transformers	134.7	134.7	141.2
500-kva transformers	147.1	147.1	160.0
Dry-type transformers	133.7	137.0	149.6
Switch and fuse panelboards	129.4	132.4	132.4
Circuit breaker panelboards	136.7	136.7	139.1
Indoor oil circuit breakers	182.5	182.5	182.5
Outdoor oil circuit breakers	156.3	178.7	213.5

Source: McGraw-Hill Department of Economics

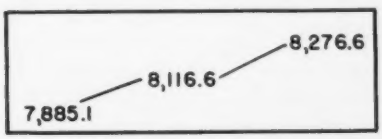
INDICATORS

Economy at a Glance

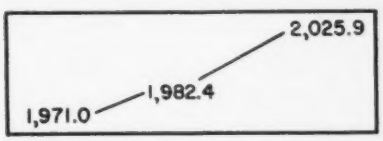
Year Ago	Month Ago	Latest Month



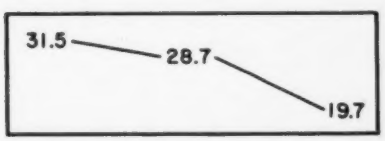
PERSONAL INCOME in millions—seasonally adjusted as of Nov. 15 (An index of consumer spending potential)



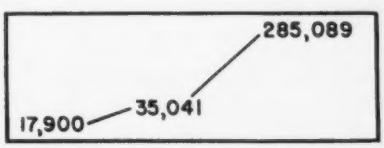
NONFARM EMPLOYMENT in thousands (An index of total industrial and commercial activity)



MANUFACTURING EMPLOYMENT in thousands (A measure of manufacturing activity)



HOUSING STARTS in thousands of units (Index of new residential customers)



INDUSTRIAL BUILDING CONTRACTS in thousands of dollars (A rough index to the dollars of electrical contracting business six months to a year ahead)

► In the surveys shown on these pages, it is important to remember that they represent the **plans** of a representative sample of business firms. And, businessmen, like women, can change their minds. In fact, plans usually do change, with the direction of change corresponding to the direction of business. For example, capital spending, which has been cut back several points this year because of disappointing sales, can just as easily turn upward if the sales curves should indicate this course.

Sources: Business Week, Bureau of Labor Statistics, Construction Daily and Engineering News-Record.

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5KV
3KV
HIGH VOLTAGE
PORTABLE CABLES WITH
HIGH NEOPRENE
CONTENT JACKET
CERTIFIED 67.32% NEOPRENE
AND BRONCO XL BUTYL INSULATION
BRONCO
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NEOPRENE
Bronco Portable High Voltage Cables are built for continuous duty under the toughest, most rugged working conditions to which you can assign a portable electrical cable. They last longer because they are doubly protected. Unsurpassed external protection against oil, ozone, sunlight, abrasion, acids and alkalies is provided by the famous Bronco 66 jacket, a seamless sheath that is certified by a Registered Professional Engineer to contain not less than 67.32% neoprene —highest content in the industry. Internally, each conductor is insulated with Bronco XL Butyl, an advanced material with great inherent dielectric strength, with extraordinary resistance to high temperatures, corona, and aging. The assembled cable is Synchro-Cured, an exclusive Bronco process that provides the cable with a high degree of resilience. Bronco 66 Certified bounces back from extreme mechanical shock, stays on the job under crushing forces that defeat lesser cables. A big plus value in Bronco's patented (U. S. Patent 2867001) branding; complete identification is repeated at exact two-foot intervals on the jacket—vulcanized in so it can't be rubbed off. Bronco 66 Certified High Voltage Types W, G, and SH (shielded types A, B, C, and D) are now available to users through Electrical Wholesale Distributors. Write for a complete description of Portable High Voltage Bronco 66 Certified. Also ask for data on our duct and direct-burial high voltage items.
ELECTRICAL CONNECTORS
DESIGNED FOR WIRE BY A WIRE MANUFACTURER
bear the name
BRONCO GRIP
Selected from the extensive Bronco-Grip line of fittings and connectors, shown here is the Type F, high compression, Visi-Grip Connector. Features: single bolt with full thread engagement, high re-usability, installed without disassembly, won't fall off line, full compression with any combination of conductor sizes, rounded contours for neat taping. Write for Bronco-Grip Catalog.
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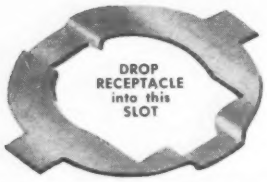
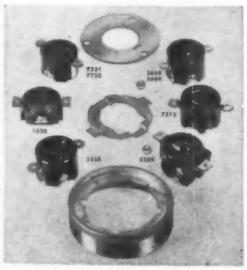


This "KEY" which is now a part of our #190 series, fits most popular style and size receptacles found on your Distributor's shelves—and stops ear clipping.

Adjusting ring for our 190 series is so designed that KEY drops easily into special slots. You select the receptacle required and simply "LAY-IN"; then "LAY-ON" receptacle ring. That's it.



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Adjustable
STEEL BOX

190-N R Series
No Receptacle

The #190 "Tru-Level" series is a standard 4" octagon, sheet steel box. It is 2¼" deep with ¾" adjusting ring and three screw legs 2¼" long which make for quick and easy tru-leveling.

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(Silver-Plated)

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Saves Power Low Watt Loss

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THE CHASE-SHAWMUT CO.
Subsidiary of I-T-E CIRCUIT BREAKER CO.
374 MERRIMAC STREET • NEWBURYPORT, MASSACHUSETTS

PROPOSED WESTERN PROJECTS

Pacific Southwest

Los Angeles, Los Angeles Co., music center and underground garage, $15,000,000. Plans by Welton Becket.

Beverly Hills, Louis Lesser Enterprises, office, $1,750,000. Sidney Eisenshtata, Los Angeles, architect.

Los Angeles, Los Angeles Federal Savings Assn., office, $2,000,000. Plans by Honnold & Rex.

Los Angeles, Los Angeles Co., central boiler plant, Los Angeles General Hospital, $1,400,000.

Van Nuys, Los Angeles City, police headquarters, $5,000,000. Plans by Daniel, Mann, Johnson & Mendenhall and Larsen, Kahn & Farrel.

Point Mugu, 11th Naval Dist., San Diego, missile launch. Plans by Kaiser Engineers, Oakland.

Pasadena, Hawkins Construction Co., executive club, $2,000,000. Plans by Paul R. Williams & Assoc., Los Angeles.

Los Angeles, Metropolitan Water District of Southern Calif., lower feeder water treatment plant, $14,000,000. James M. Montgomery, Pasadena, consulting engineer.

Fullerton, St. Judes Hospital, hospital additions, $1,850,000. Plans by Welton Becket & Assoc., Los Angeles.

Mercury, Nev., Atomic Energy Commission, test cell D, $7,000,000-$8,000,000. Plans by Aeroject General Corp., Covina, Calif.

Pacific Northwest

Othello, Wash., U. S. Engineers, Seattle, electrical distribution system, over $100,000.

Seattle, Port of Seattle, containership terminal, $6,500,000, rebuilding pier 28, $3,500,000, transit shed, $850,000, grain terminal improvements, $500,000.

Hillsdale, Calif., David D. Bohannan Organization, San Francisco, fashion stores, $4,000,000. Welton Beck & Assoc., architects.

Sunnyvale, Lockheed Aircraft Co., engineering and laboratory building, $4,000,000.

Oakland, U. S. Post Office Department, mechanized mail facilities, $12,000,000. Plans by Stone, Marraccini & Patterson, San Francisco.

San Mateo, Junior College Dist. additions, $10,000,000. Plans by John Carl Warnecke & Assoc., San Francisco.

Berkeley, Regents, University of California, renovating electron volt Bevatron, including construction of thicker shielding walls, $9,000,000.

Monterey, 12th Naval District, Public Works, San Bruno, Science School, including reference center, lecture hall, classrooms, laboratories, faculty housing, $5,000,000, Welton Becket & Assoc., architects-engineers, San Francisco.

Alaska and Hawaii

Bethel, Alaska, U. S. Engineers, Anchorage, primary power modification, Bethel Air Force Station, over $100,000.

College, University of Alaska, Gymnasium, voted bonds Nov. 8, $1,600,000, L. A. Forrest, Juneau, architect.

Bethel, U. S. Engineers, Anchorage, dormitory, electric power, Northeast Cape Air Force Station, $1,360,000.

Anchorage, State Department, Juneau, state office, voted bonds Nov. 8, $3,000,000.

Halawa, City and Honolulu County, firemen training center, $10,558,000, plans by C. J. Kim, Honolulu.

Honolulu, State of Hawaii, State Capitol building, $14,500,000, plans by Belt, Lemmon & Lo, and John Carl Warnecke, Honolulu.

Honolulu, City and Honolulu County, War Memorial Auditorium, $5,000,000, plans by Adrian Wilson, Los Angeles.

Honolulu, 287-unit cooperative apartment, garage and swimming pools, $6,500,000, Alan Sanford Davis.

Rocky Mountain

Albuquerque, N. M., City, brick and aluminum city hall, $1,700,000. Plans by James Liberty.

Casper, Wyo., Pacific Power & Light Co., power lines, $800,000.

Moab, Utah, Texas Gulf Sulphur Co., processing plant, mine shaft, aerial tramway, etc., $22,500,000.

Anaconda, Mont., Strategic Materials Corp., New York, steel plant, $20,000,000. Koppers Co., consulting engineers.

Great Falls, Federal Services Administration, Seattle, post office and courthouse alterations, $781,000. Plans by Knight & van Teylingen.

Pocatello, Idaho, State Dept. Public Works, college education building, $1,794,500.

Lakewood, medical arts building, $1,000,000. Murrin Kasch, Kahn & Assoc., architects in Denver.

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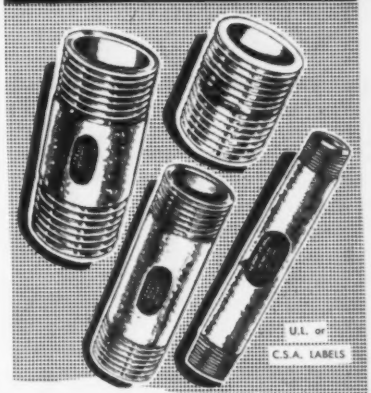
Box 270, Guelph, Ont.

RIGID *Conduit* PIPE NIPPLES



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Hot Dip Galvanized

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Estimator's Guide

Prices shown are for new construction cost in place. Quotations furnished by LeRoy Construction Service

The figures in this guide, furnished by LeRoy Construction Service, will be kept up to date and published periodically. This guide is for your use. Will you please let the editor know if there are other figures or ideas which would make this section more valuable to you?

Residential Wiring

PER OUTLET, 120 V—2 WIRE	
Knob & tube	Each 8.50
Nonmetallic cable	Each 8.00
Armored cable (BXL)	Each 16.00
Armored Cable (BX)	Each 10.00
Flexible metallic conduit	Each 18.00
EMT	Each 20.00
Conduit rigid	Each 23.00
PER OUTLET, 230 v—3 Wire (RANGE—OVEN—WALL HEATER)	
Nonmetallic cable (Romex)	Each 14.00
Flex conduit (Greenfield)	Each 22.00
EMT	Each 23.00
SERVICE & PANEL	
Light panel & service 50 amp lugs 120/240 v—3 wire 4 1 pole circuit, 15 amp fused	70.00
Light panel & service 100 amp ACB 120/240 v—3 wire 4 1 pole circuit, 15 amp 2 2 pole circuit, 20 to 50 amp	150.00
Light panel & service 100 amp—ACB 120/240 v 6 1 pole circuit, 15 amp 3 2 pole circuit, 20 to 50 amp	165.00
Light panel & service 100 amp—ACB 120/208 v, 3 phase, 4 wire 8 1 pole circuit, 15 amp 2 2 pole circuit, 20 to 50 amp 2 3 pole circuit, 15 to 30 amp (Required for air conditioning system)	225.00
INSTALL LIGHT FIXTURES (Fixtures Purchased on Allowance)	
Incandescent	Each 4.00
Fluorescent	Each 5.00
Yard light	Each 5.00
Bathroom exhaust fan	Each 50.00
Garden pedestal light fixture	Each 40.00

Commercial Wiring—Conduit

FLEXIBLE METALLIC	Per C
½"	32.50-36.00
¾"	37.50-43.50
1"	63.00-69.00

RIGID GALVANIZED	Per C
½"	49.00- 54.00
¾"	62.00- 68.00
1"	79.50- 87.00
1¼"	103.00-115.00
1½"	121.50-132.00
2"	160.00-175.00
2½"	229.00-252.00
3"	298.50-325.00
3½"	365.50-401.00
4"	417.50-456.00
5"	624.50-685.00

Commercial Wiring—EMT

	Per C
½"	34.50- 38.00
¾"	43.50- 48.00
1"	58.00- 64.00
1½"	83.00- 90.00
1¼"	70.50- 76.00
2"	103.00-112.00

Commercial Wiring—RHW

WIRE 600 V—75°	Per M
750 mcm, stranded	2,011.00-2,090.00
700 mcm, stranded	1,867.00-1,940.00
600 mcm, stranded	1,675.00-1,742.00
500 mcm, stranded	1,401.00-1,457.00
400 mcm, stranded	1,140.00-1,185.00
300 mcm, stranded	923.00- 960.00
250 mcm, stranded	830.00- 860.00
No. 4/0, stranded	690.00- 717.00
No. 3/0, stranded	567.00- 589.00
No. 2/0, stranded	451.00- 965.00
No. 1/0, stranded	378.50- 393.00
No. 1, stranded	322.50- 335.00
No. 2, stranded	240.00- 249.00
No. 4, stranded	182.50- 190.00
No. 6, stranded	137.00- 142.00
No. 8, stranded	106.50- 110.00
No. 10, stranded	80.50- 83.00
No. 12, stranded	66.00- 68.00
No. 14, stranded	57.00- 59.00
No. 8, solid	99.00- 102.00
No. 10, solid	75.00- 78.00
No. 12, solid	61.00- 63.00
No. 14, solid	52.50- 54.00

Commercial Wiring—TW

WIRE 600 V—75°	Per M
750 mcm, stranded	1,850.00-1,924.00
600 mcm, stranded	1,537.00-1,598.00
500 mcm, stranded	1,300.00-1,350.00
400 mcm, stranded	1,017.00-1,057.00
300 mcm, stranded	850.00- 882.00
250 mcm, stranded	750.00- 780.00
No. 4/0, stranded	635.50- 660.00
No. 3/0, stranded	543.00- 564.00
No. 2/0, stranded	432.50- 449.00
No. 1/0, stranded	356.50- 370.00
No. 1, stranded	306.00- 318.00
No. 2, stranded	227.00- 236.00
No. 4, stranded	173.00- 179.00
No. 6, stranded	129.50- 134.00
No. 8, stranded	95.00- 98.00
No. 10, stranded	73.00- 75.00
No. 12, stranded	59.50- 61.00
No. 14, stranded	51.50- 53.00
No. 8, solid	87.00- 90.00
No. 10, solid	68.00- 70.00
No. 12, solid	55.00- 57.00
No. 14, solid	47.50- 49.00

Commercial—Outlets & Connections

Conduit and wire not included

	Each
Light fixture outlet	
Recess	8.00
Surface	7.00
WP	8.00
Duplex outlet	
15 amp	9.00
15 amp WP	10.00
Clock outlet	9.00
Floor outlet, flush	17.00
Floor outlet, pedestal type	23.00
Outlet, 240 v, 3 wire, 1 phase, 30 to 50 amp	13.00
Outlet, 240 v, 4 wire, 3 phase, 30 to 50 amp	16.00
Switch, single pole	9.00
Switch, double pole	10.00
Switch, 3 way	10.00
Switch, single pole w/pilot	12.00
Switch, momentary contact	10.00

Motor Outlet & Connection

GREENFIELD FLEXIBLE CONDUIT	Each
Fractional hp, 120 v, 1 phase	11.00
Fractional to 3 hp, 240 v, 3 phase	13.00
5 to 10 hp, 240 v, 3 phase	14.50
15 to 25 hp, 240 v, 3 phase	18.00
30 to 50 hp., 240 v, 3 phase	26.50
60 to 100 hp, 480 v, 3 phase	35.00
For Sealtite add 25%	
For explosionproof add 50%	

Power & Control Equipment

MOTOR DISC. SWITCH TYPE C NONFUSIBLE STD. DUTY 250 V	Each
30 amp, 2 pole, 240 v	19.00
30 amp, 3 pole, 240 v	21.50
60 amp, 3 pole, 240 v	34.00
100 amp, 3 pole, 240 v	52.00
200 amp, 3 pole, 240 v	84.50
400 amp, 3 pole, 240 v	178.00
600 amp, 3 pole, 240 v	280.00
30 amp, 3 pole, 575 v	22.00
60 amp, 3 pole, 575 v	36.00
100 amp, 3 pole, 575 v	54.00
200 amp, 3 pole, 575 v	88.00
400 amp, 3 pole, 575 v	184.00
600 amp, 3 pole, 575 v	290.00
PUSHBUTTON STATION	
NEMA 1, std. duty	
One button	14.50
Two button	17.00
Three button	22.50
NEMA 1, heavy duty	
One button	20.00
Two button	27.00
Three button	34.00
NEMA 4 & 5, std. duty	
One button	32.50
Two button	34.00
Three button	38.50
NEMA 4 & 5, heavy duty	
One button	37.50
Two button	42.50
Three button	61.00
MOTOR STARTERS—MANUAL	
Size 00—1 pole, 120/208 v	17.00
Size 00—2 pole, 240/480 v	19.00
Size 0—2 pole, 240/480 v	32.00
Size 1—2 pole, 240/480 v	37.00
Size 0—3 pole, 240/480 v	41.00
Size 1—3 pole, 240/480 v	46.00
MOTOR STARTERS—MAGNETIC RESET ONLY IN COVER	
Size 0—2 pole, single phase	47.00
Size 1—2 pole, single phase	52.00
Size 1½—2 pole, single phase	67.00
Size 0—3 pole, 3 phase	55.00
Size 1—3 pole, 3 phase	60.00
Size 2—3 pole, 3 phase	107.00
Size 3—3 pole, 3 phase	173.00
Size 4—3 pole, 3 phase	365.00
MOTOR STARTERS—MAGNETIC START, STOP, RESET IN COVER	
Size 0—2 pole, single phase	56.00
Size 1—2 pole, single phase	62.00
Size 1½—2 pole, single phase	77.00
Size 0—3 pole, 3 phase	63.00
Size 2—3 pole, 3 phase	68.00
Size 2—3 pole, 3 phase	116.00
Size 3—3 pole, 3 phase	183.00
Size 4—3 pole, 3 phase	374.00
UNDERFLOOR DUCT SYSTEM	
Duct, No. 2, single run, including junction boxes and misc. ftgs., etc.	Per ft 2.90
Duct No 4, single run, including junction boxes and misc. ftgs, etc.	Per ft 3.20
Pedestal underfloor duct outlet, power	Each 16.50
Pedestal underfloor duct outlet, telephone	Each 14.00

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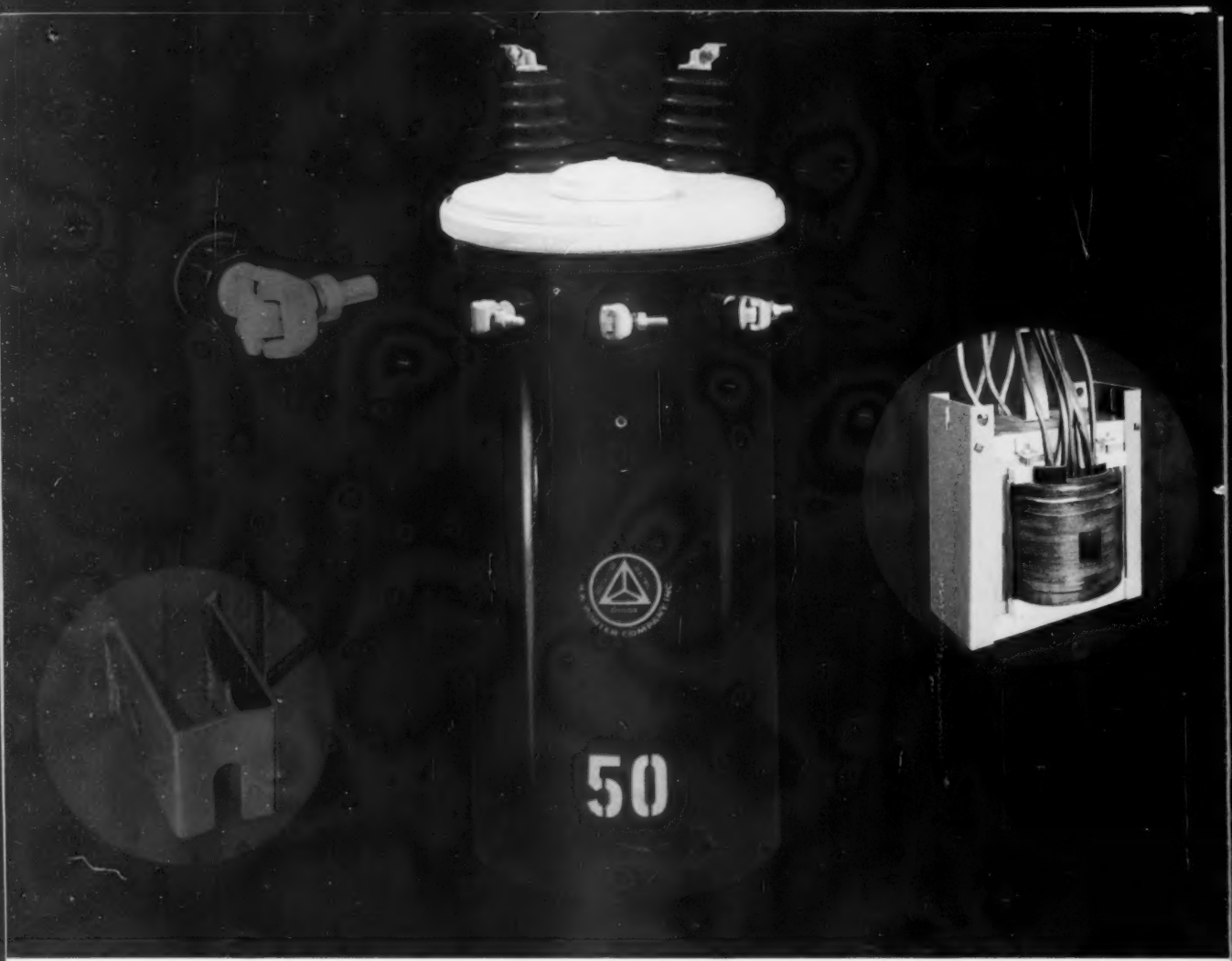

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